THE MARINE REVIEW

LATEST AMERICAN-HAWAIIAN STEAMER "MINNESOTAN"

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American-Hawaiian Steamers

A Fine Fleet is Being Created in Anticipation of Increased Business Through the Panama Canal

THE American-Hawaiian Steamship Co. is having built at the yard of the Maryland Steel Co., Sparrows Pt., Md., eight steamers in anticipation of additional business after the opening of the Panama canal. Rapid progress is being made in the construction and all the vessels will be in commission before the canal is opened to navigation next September.

The route on which these vessels are to be placed is from New York to San Francisco and Hawaiian Islands by way of the canal. Special attention has been paid to the arrangement of hatches for shipping large timbers. After the canal has been opened to the marine traffic of the world, the owners will insulate the upper 'tween decks for the purpose of carrying tropical fruits, the builders having created a suitable steel house on the shelter deck ready for the installation of the refrigerating machinery.

The owners specified one radical departure from their previous boats. They desired to take advantage of the decrease in weight that the longitudinal system of framing allows and thereby increase the earning power of the ships. All eight vessels are to be built on the Isherwood system, the company also recognizing the advantages gained by clearer holds, besides increased deadweight.

The Minnesotan, the first of the order to be launched, made her initial trip down the ways on June 8, followed by the Dakotan, on Aug. 10. The Minnesotan was delivered to her owners on Sept. 10. The principal dimensions of these boats are: Length between perpendiculars 414 ft. beam molded 53 ft. 6 in., depth molded to shelter deck 39 ft. 6 in., depth molded to upper deck 31 ft. 6 in. The vessels are built to the highest requirements of Lloyds under special survey, and are classed 100 A-1. The ships will carry 9,450 tons of deadweight on a draught of 28 ft. and maintain a service speed of 12 knots per hour.

Burn Either Coal or Oil

All have straight stems, elliptical sterns, three continuous steel decks with an additional steel orlop deck in No. 1 hold. The propelling machinery is located amidships, just forward of which is a deep tank with an oil-tight center line bulkhead for carrying either coal, cargo or fuel oil. At each end of ship is located a peak tank for carrying fuel oil or water ballast. The double bottom extends the entire length of boat with an oil-tight center keelson and is divided longitudinally into eight tanks, the three under the machinery space being intended for carrying feed water. Oil wells are built in to separate these tanks from the remainder, which are to be used for fuel oil or water ballast.

When it is decided to use coal instead of fuel oil in the boilers, the coal will be carried in a bunker on the second deck abreast the machinery space and in the deep tank. The combined bunkers have a capacity of 900 tons. A steel shaft alley is built in the two after holds, extending from machinery space to the after peak bulkhead. The ship's stores are carried at each end of second deck over peak tanks.

The vessels are fore and aft schooner rigged, with two steel masts and four king posts. The masts have eight booms each, one on the foremast being of 30-ton and one on the mainmast of 20-ton capacity. All other booms are capable of handling 5 tons. Each forward king post is fitted with two booms and the after ones with one each; the king post booms are of 3-ton capacity. All cargo booms are of seamless steel tubing imported from the Mannesmann Tube Works, Dusseldorf. To facilitate the handling of freight, four cargo ports are fitted to the lower 'tween decks and six to the upper 'tween decks. On each deck are six large hatches with wooden covers and in addition numerous small trimming hatches are distributed throughout on upper and second decks.

The deck machinery is composed of

a Hyde vertical wildcat pattern steam windlass with engine on deck below. Warping heads are fitted above wildcats. Four double geared and 10 single geared winches with single drums and gypsy heads are installed for handling freight; the winches have 9 in. by 14 in. double cylinders. Two heavy steam deck capstans with 9 in. by 9 in. cylinders fitted on deck, one forward and one aft. The steering engine is a Hyde geared quadrant type operated by means of a Brown telemeter from the pilot house, flying bridge and steering engine room. The engines are twin vertical engines, each capable of handling the rudder under any condition. The deck equipment consists of two 26 ft. metallic life boats, one wooden 20 ft. cutter and one wooden 22 ft. gig. All boat davits are Norton's patented screw gear type.

The accommodations for the passengers, officers and crew are large and airy, the aim being to make the quarters as comfortable as possible, as a considerable portion of each trip is in the tropics. The quartermasters, carpenter and boatswain are quartered in the forward end of upper 'tween decks. Their stores, lamp room, wash and toilet room are forward. At the after end of the upper 'tween deck the watertenders, oilers, seamen, firemen, wash and toilet rooms are installed.

The midship house contains dining saloon and pantry, officers' mess room and pantry, two spare staterooms, store rooms, freight clerk, cooks, steward, mess boys, chief, first, second, third, deck and refrigerating engineers, and bath and wash rooms. In a steel house at after end of shelter deck the hospital with bath and spare staterooms are fitted.

On the boat deck is located four staterooms and bath, wireless room, pilot house, chart room, first, second and third officers, officers' bath and the captain's stateroom, office and bath room. At each end of lower 'tween decks special freight rooms are bulkheaded off for bonded freight.

Propelling Machinery

The power plants for these ships are similar in design to that installed in the steamers Kentucky, Georgian and Honolulan, and consist of one four-cylinder, quadruple-expansion engine, three single end Scotch type boilers and the necessary auxiliaries.

The main engine cylinders are 25½, 37, 53½ in. and 76 in. in diameter by 54 in. stroke, having piston valves throughout and are supported by heavy box columns fitted with double slipper guides. The main air pump, two bilge pumps and an oil pump for forced lubrication to thrust block, are attached to L. P. engine. The crank shaft is 15¼ in. in diameter, and is in four interchangeable pieces, the cranks being set at equal angles.

The propeller, which is 18 ft. 6 in. diameter by 18 ft. 6 in. mean pitch, has a cast steel hub with manganese bronze blades. The main boilers are 16 ft. mean diameter by 12 ft. 3 in. long, designed to meet the requirements of Lloyd's inspection rules for 215 lbs. working pressure. Each boiler contains four 41-in. inside diameter corrugated furnaces. The tubes are 2¼ in. diameter and the total heating surface is 3,173 sq. ft. per boiler.

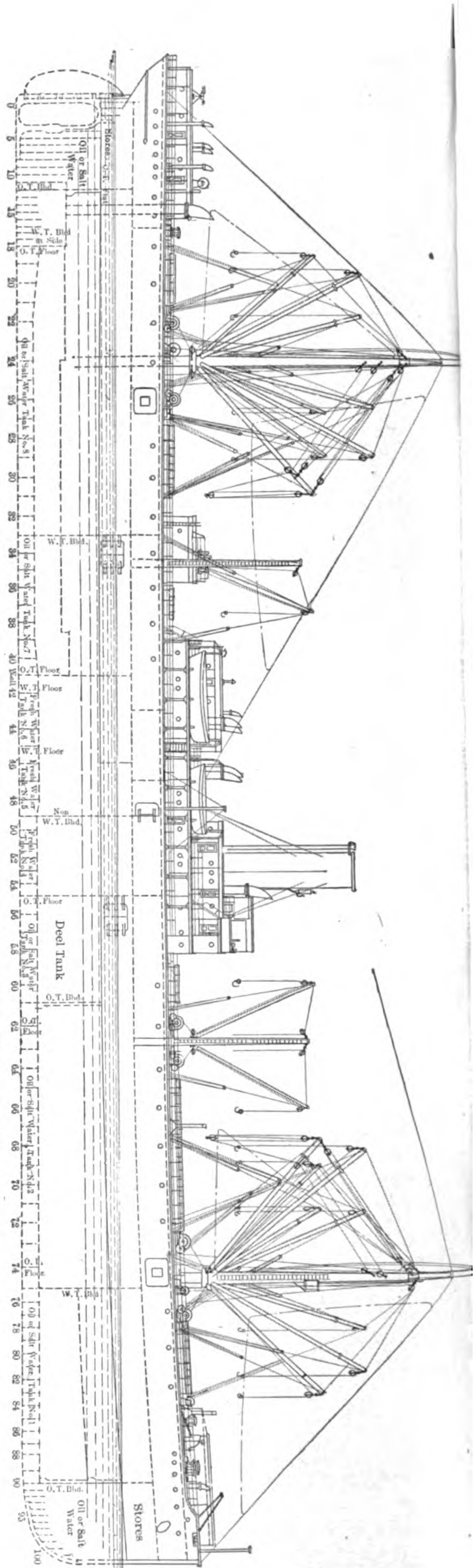
The boilers extend through the engie room bulkhead and have all connections on the back heads in engine room. They are fitted with the Howdden's system of forced draft and are built to burn either oil or coal as fuel. It is the intention to burn oil for the greater part of the time, but all the necessary grate bars, etc., are carried so that the change to coal may be made at any time. When burning oil the steam atomization system is used with the necessary pumps, oil heaters and filters, etc., carried on the forward fire room bulkhead. The fuel oil system throughout is furnished in duplicate. The donkey boiler is 10 ft. diameter by 9 ft. 6 in. long, built for 215 lbs. per sq. in. working pressure and to burn either coal or oil fuel.

There are also provided two long stroke simplex feed pumps, a duplex fire and bilge pump, an oil trim pump, a duplex ballast pump, a fresh water pump, an auxiliary condenser with attached air and circulating pumps for port use, a 14-in. centrifugal circulating pump, two 20-ton evaporators with pump, two distillers with pump and aerating tank, a forced draft blower, a 2-ton refrigerating plant and a multicoil feed heater. A drill press, a lathe and an emery wheel are installed on the starboard side in engine room and operated by an electric motor.

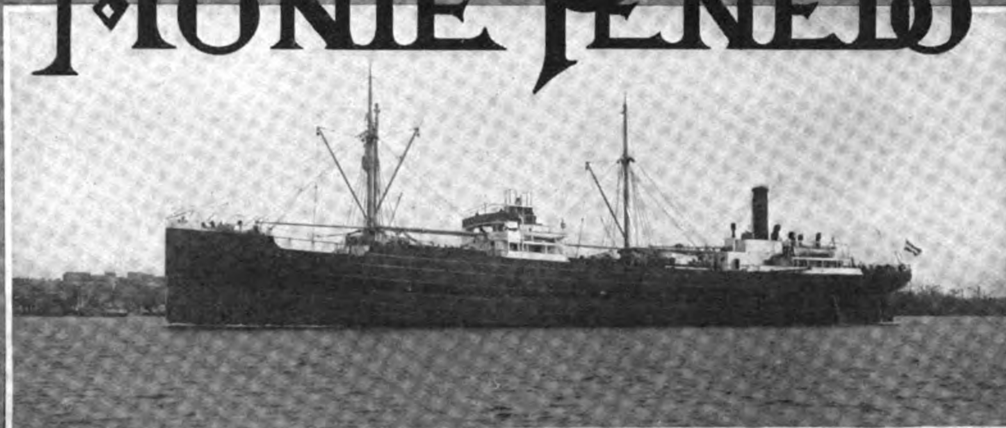
A system of mechanical ventilation for the cargo holds has been installed with two motor-driven fans located in engine casing.

Glasgow's oversea trade is worldwide and her ships are to be found in all quarters of the globe. Last year 13 different nations were represented at one time or other at Glasgow, and the number of countries has been as high as 17, but not a single American-owned ship has reached the Clyde since 1906.

Inboard Profile of the American-Hawaiian Steamship Co.'s New Steamer Minnesotan



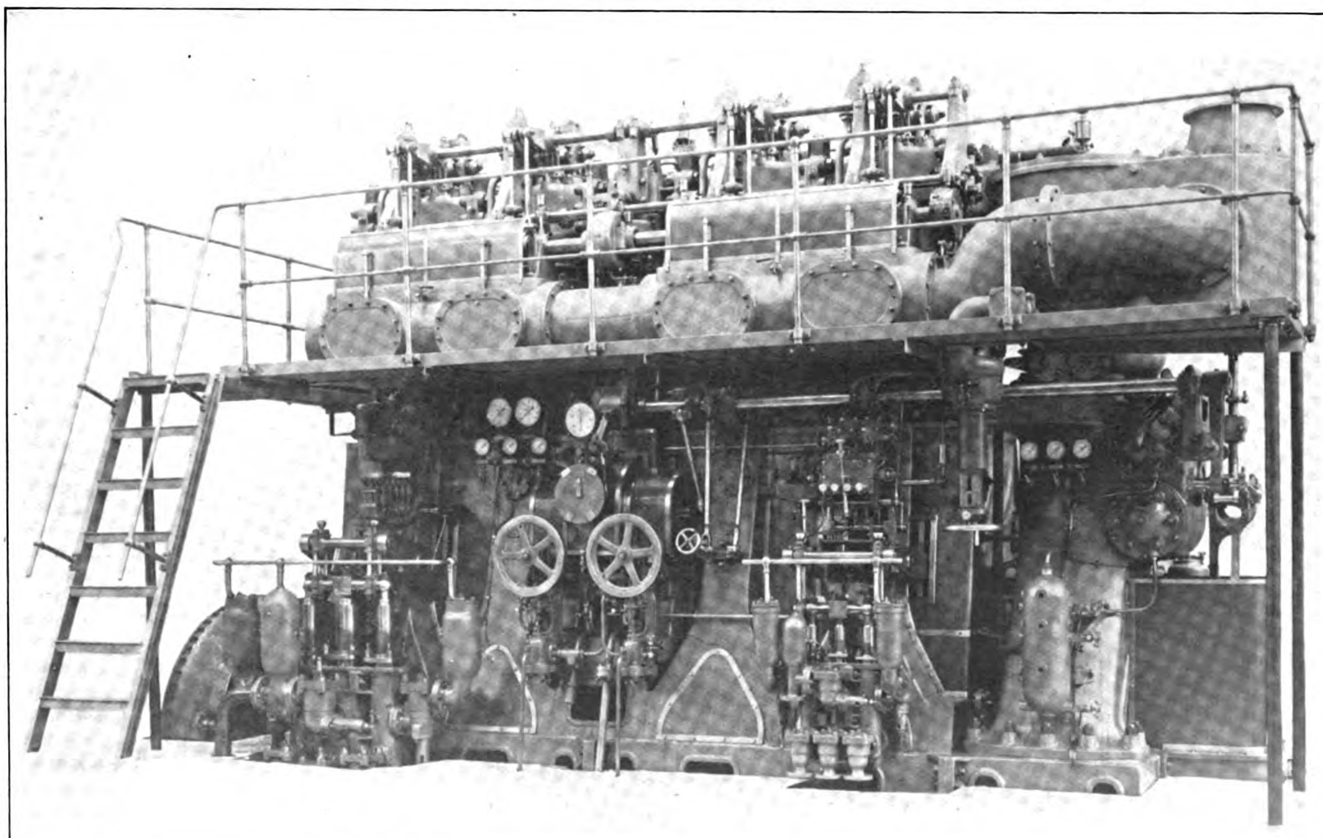
MONTE PENEDO



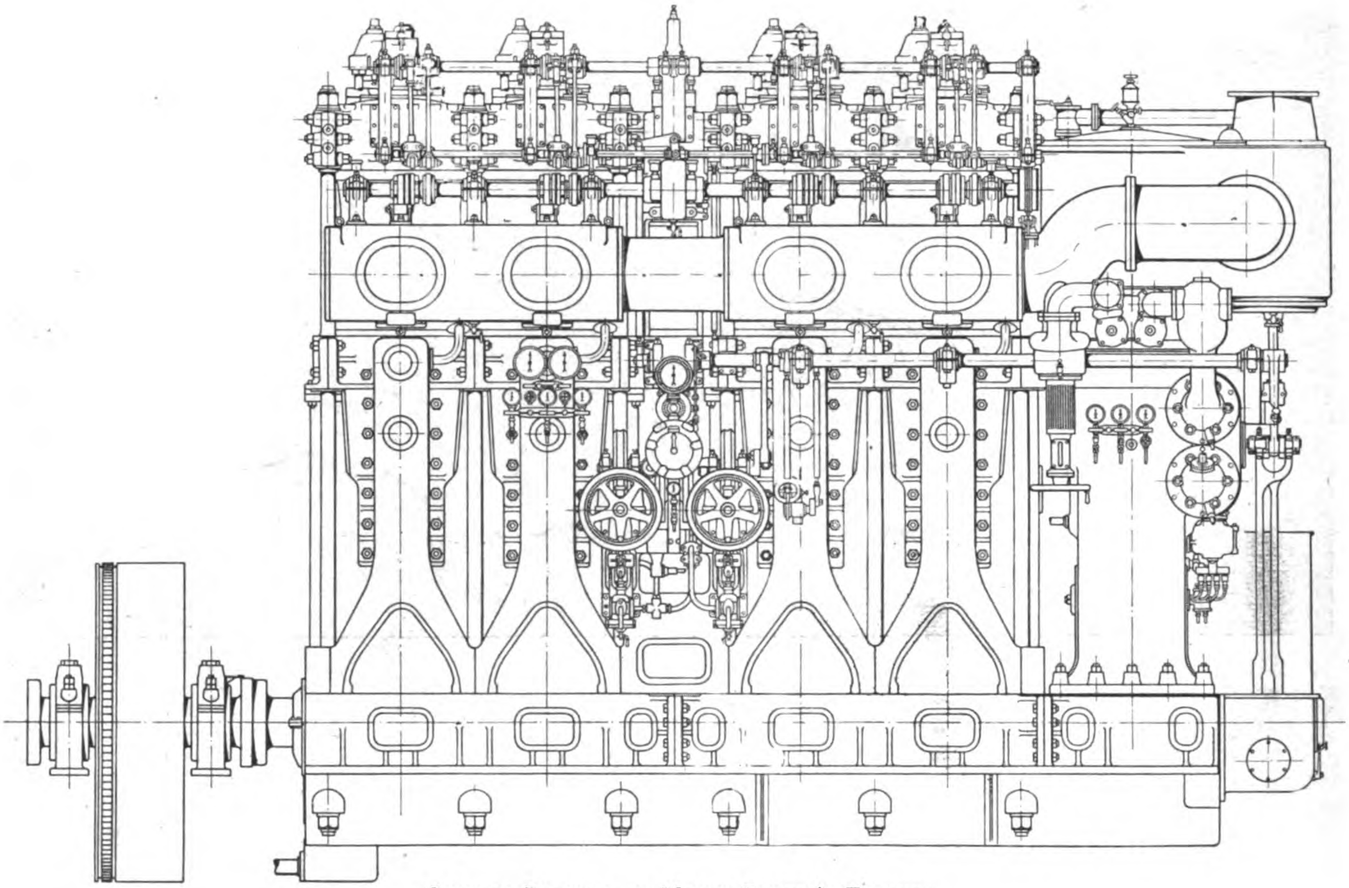
THE NEW HAMBURG-SOUTH AMERICA MOTOR-DRIVEN SHIP

IN THE shipping world considerable interest is being taken in the combat for supremacy between the four-cycle and two-cycle Diesel oil engines. To the four-cycle type fell all the early honors, and though the ultimate superiority of the two-cycle engine is scarcely to be denied, owners are anxious to learn whether this type is satisfactory in the present state of the art. The first motor ship to cross the Atlantic, the Toiler, which came to the Great Lakes, had two-stroke engines, but they were of small power and did not afford any useful information concerning the size of motors required for the regular ocean-going ships. The first really important two-cycle installation completed was that of the Eavastone, 3,200 tons dead weight, for the Furness Withy line, to which extended attention was given in the September issue of THE MARINE REVIEW. The present article has to do with the new Hamburg South American motor ship, Monte Penedo, having a two-cycle engine of the Sulzer-Deisel type.

Monte Penedo, which is 350 ft. long, 50 ft. broad, 27 ft. deep and measures 4,000 tons gross, can carry about 6,500 tons deadweight. Compared with a triple-expansion steam installation the motor machinery shows a reduction of 250 tons in weight. Computed upon a voyage from Hamburg



ONE OF THE 1,000 I. H. P. SULZER-DIESEL TWO-CYCLE, SINGLE-ACTING ENGINES OF THE MONTE PENEDO



General Diagram of Monte Penedo's Engines

to Buenos Aires, 13,500 miles, the fuel consumption of the new motor ship will be 430 tons against the 1,750 tons of an equivalent steamer with a triple-expansion engine, giving a gain of 1,320 tons for cargo outward and 660 tons homeward or a mean of 990 tons on the round voyage. A steamship with a quadruple-expansion engine might have a coal consumption of only 1,500 tons on the round voyage, and allow a mean gain of 800 tons for cargo to the motor ship. These figures relate to 2,000 I. H. P. and a speed of 10½ knots, representing the engine power and speed respectively of the Monte Penedo, to which therefore a gain of 16 per cent in cargo-carrying capacity has to be credited in comparison with a vessel having a quadruple-expansion engine and just under 20 per cent gain compared with a ship having triple-expansion. The additional hold capacity afforded to the motor ship by her reduced engine room and bunkerage is reported to be 30,000 cu. ft. And over and above these advantages the owners will profit by an economy of $30,000 per annum on engine room wages, leaving out of account altogether the difference in fuel bills, which, as a result of oil-bunkering on the American side, should be considerably to the credit of the motor vessel.

Two-Cycle, Single-Acting Type

The main engines are of Sulzer's two-cycle single-acting type, developing each 1,000 I. H. P. at 160 revolutions per minute, and having cylinders 470 mm. diameter and 680 mm. stroke. The bed plate is cast in three sections, and upon it are the hollow cast iron columns, which make the engine rigid and take up the transverse stresses. Steel columns are bolted

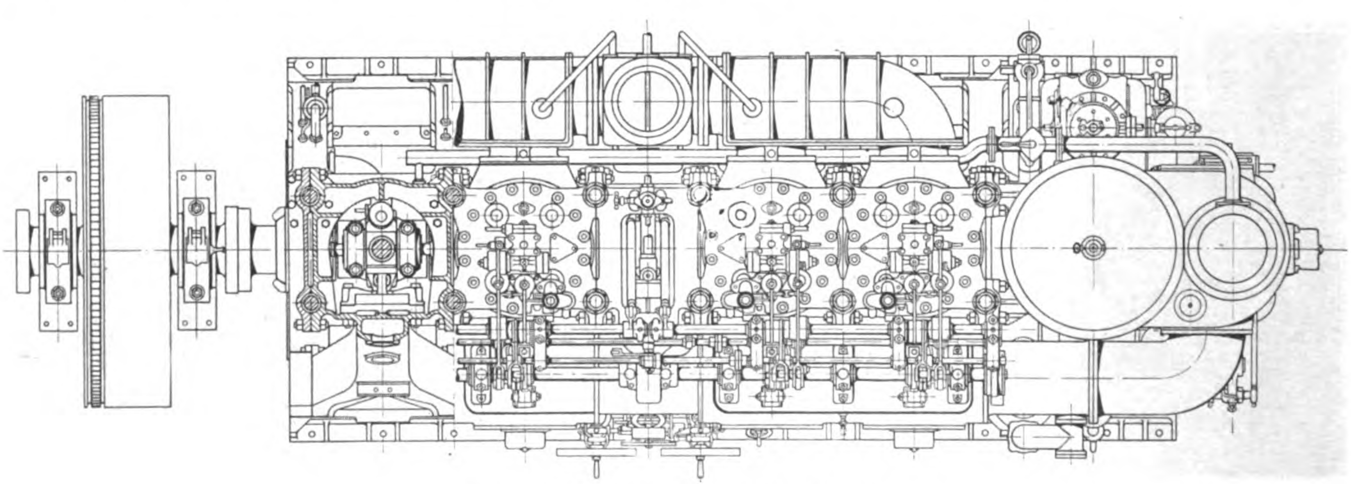
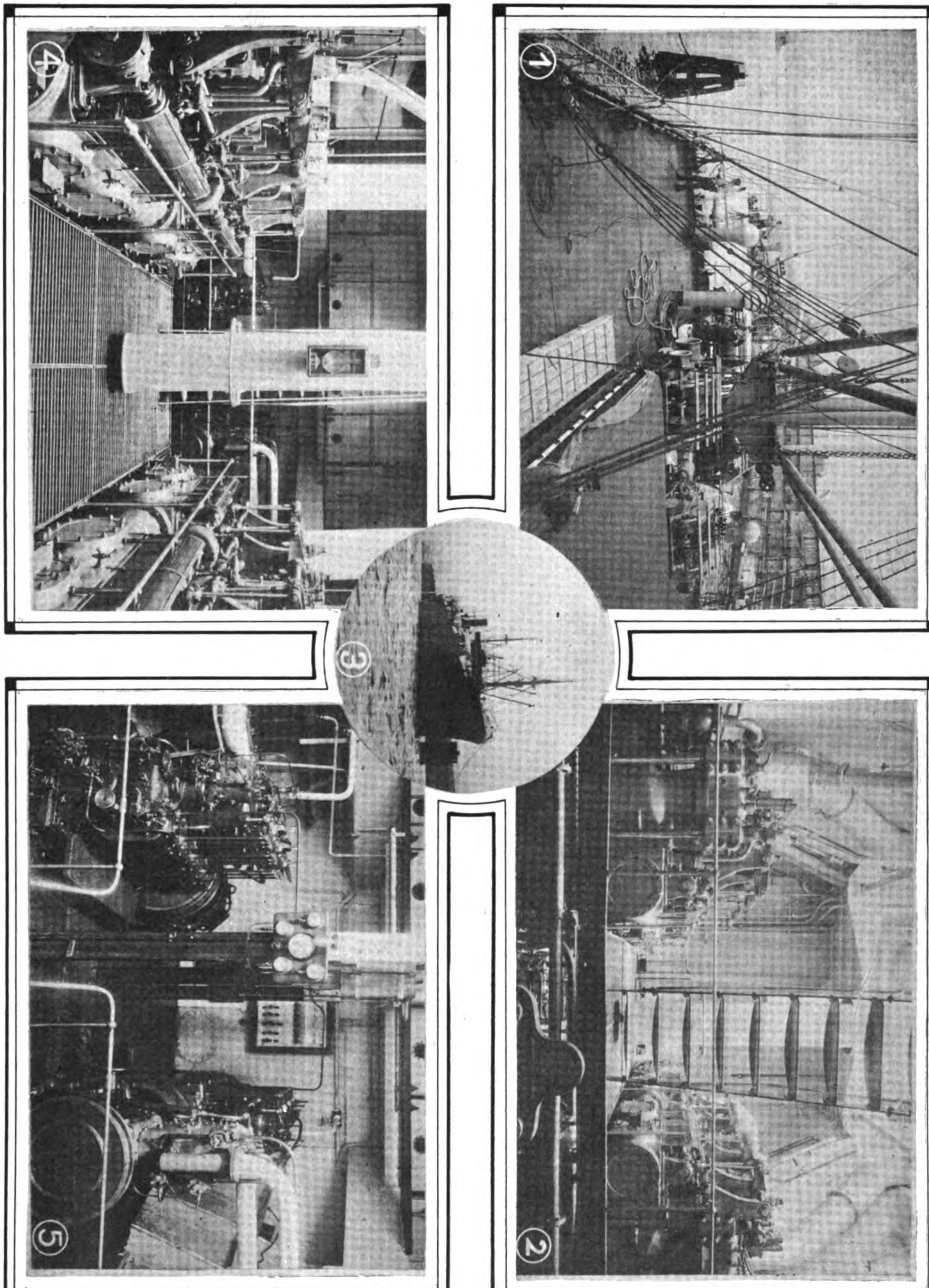
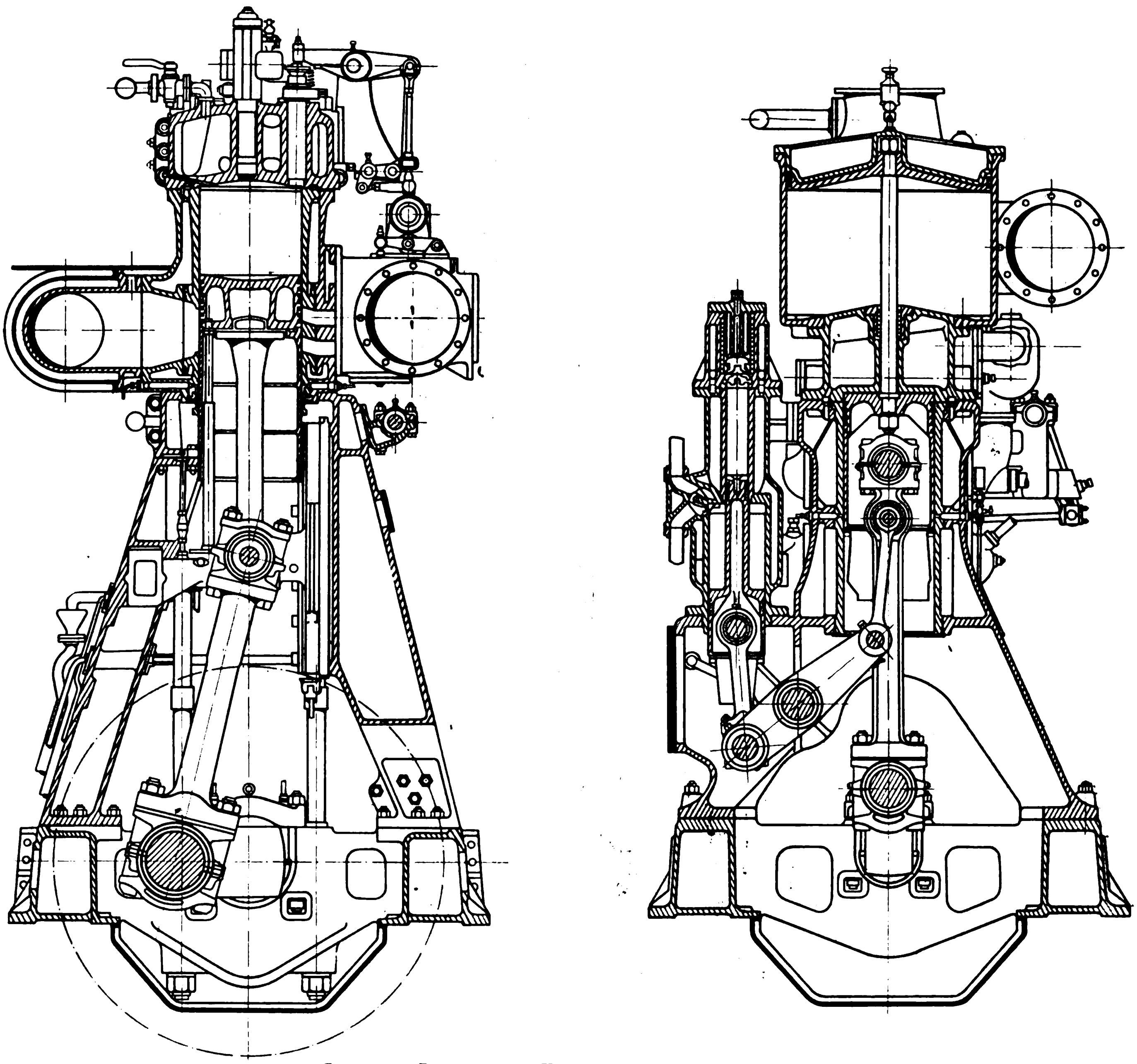


Diagram of Monte Penedo's Engines



1—The Forward Winches and Derricks. 2—The Cam Shaft Platform Between the Twin Diesel Engines of the Monte Penedo, View From After End. 3—Bow View of the Monte Penedo. 4—The Cam Shaft Platform Between the Twin Diesel Engines of the Monte Penedo, View From Forward End. 5—Two Auxiliary Diesel Engines of the Monte Penedo



SECTIONAL DRAWINGS OF ENGINES OF THE MONTE PENEDO

right through from the cylinder heads to the bed plate, and therefore the stresses communicated to the crowns through the operations in the cylinders are not imposed upon the cylinder bodies proper. Single-type guide shoes, white metal lined, are fitted to the crossheads, and the guide plates are both water-cooled and adjustable. Large doors are fixed on the back of the engine, giving easy and convenient access to the reciprocating parts and bearings. The front of the engine is completely enclosed. The working pistons are water-cooled, the water being passed in and out through telescopic tubes without stuffing boxes. Cranks are at 90 degrees, except the scavenging pump crank at the forward end of the engine. The scavenging pump is double-acting, and is controlled by a piston valve driven through a Stephenson's link motion, which simplifies reversing.

As a sort of crosshead to the scavenging pump, there is the low-pressure piston of the compressor immediately beneath, and the two higher stages of compression take place at the side in superimposed cylinders, the pistons of which are driven by balanced levers off the connecting rod of the bigger pump mechanism. Automatic valves being provided in the compressor, there is no need for a reversing device in connection with it. The scavenging air enters the cylinder through two rows of horizontal ports at the bottom, the lower row being controlled by the piston alone, while the upper is regulated by scavenging valves before it is covered by the piston. Through the upper ports a positive control is obtained over the quantity of air sent into the cylinder after the lower row has been covered. The scavenging valves are directly operated from the underside of the camshaft. Opposite the scavenging ports and equal in depth to both rows approximately are the exhaust ports leading to a water-cooled pipe. It is to be observed that in this design there are only the injection and starting valves in the cylinder covers, simplifying the heads and reducing very considerably the multiplicity of valve-operating mechanism and reversing gear. Two small air engines operate the maneuvering mechanism, one serving to carry through the displacement of the valve gear for running, starting and stop-

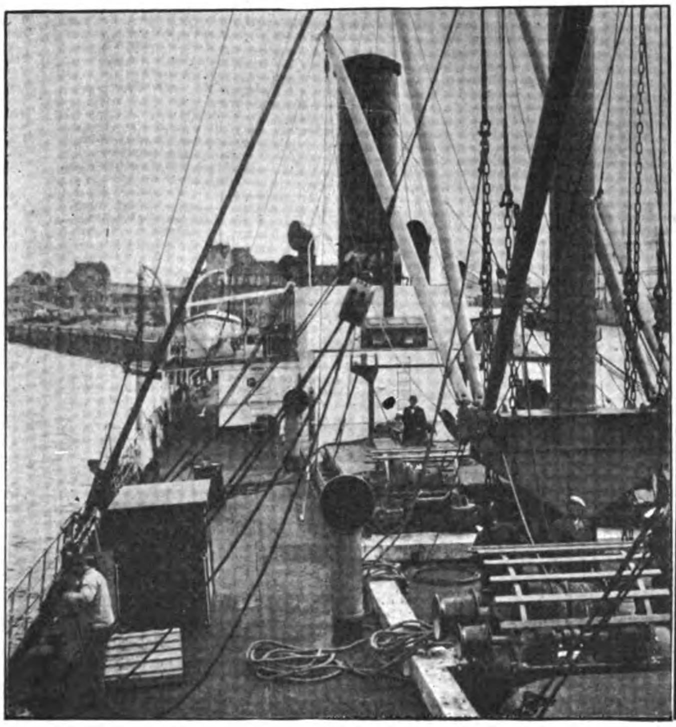
ping, and the other being used to alter the timing of the camshaft and of the scavenging pump valve to suit the reversed direction of running. The well-known eccentric mounting of the fuel and starting valve rockers in differential fashion is employed to give the change-over from air-power to fuel-working, and this is independently carried out for the cylinders in pairs.

Sequence of Operations

The sequence of operations in the regulation of the motor is simple and easily understood. When the engine is at rest the valve rod rollers are clear of the camshaft. When the first maneuvering engine is turned—which effects this has for further result the bringing of the corresponding two fuel valves into gear; the next operation is the final turn of the wheel to rotate the second top shaft and bring down the two fuel valves of those cylinders while lifting the starting valves away. Just below the two maneuvering wheels is the lever which controls the quality of fuel admitted to the cylinders and so regulates the speed of the engine. To reverse the engine, the two wheels are brought back to "stop," and then carried round in the opposite direction one after the other. The first wheel alters the timing of the camshaft by lifting the vertical geared shaft, reverses the links of the scavenging pump valve, taken off the cross-heads of both No. 1 and No. 4 cylinders. They supply cooling water for the working cylinders, pistons, compressor-cylinders, and intercoolers.

Auxiliary Machinery

The auxiliary machinery consists of two three-cylinder four-stroke Sulzer-Diesel engines of 50 H. P. They have cylinders 205 mm. by 220 mm., and run at 425 revolutions per minute. One is coupled direct to a dynamo which serves for the lighting of the ship; the other drives a compressor for use in case of emergency or failure of the ordinary supply, but particularly for use when entering or leaving port, when large quantities



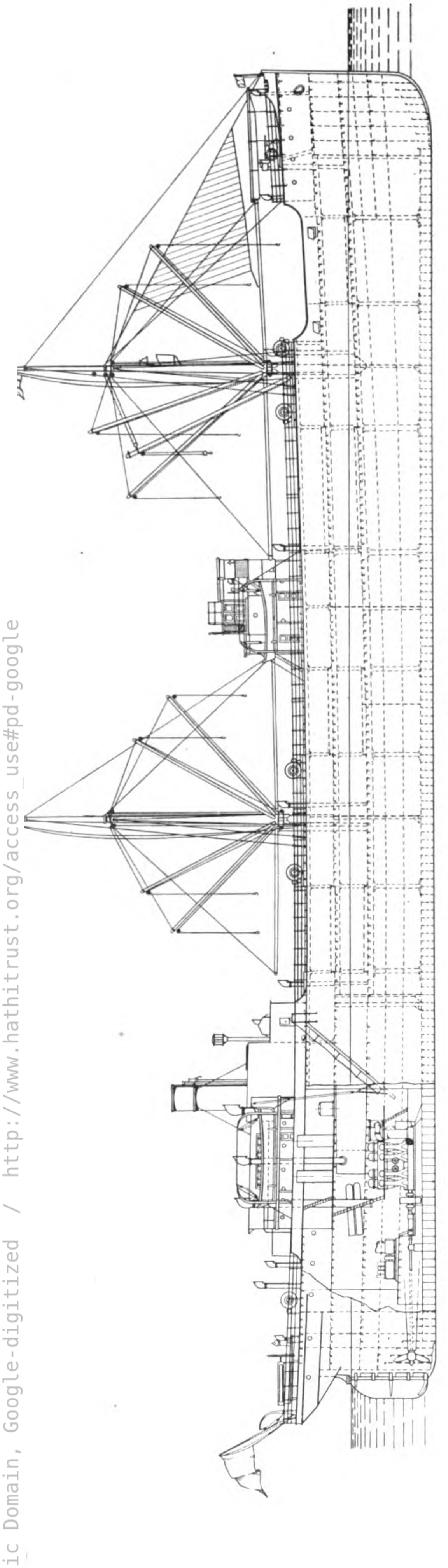
THE AFTER WINCHES AND DERRICKS OF THE MONTE PENEDO

THE MONTE PENEDO FROM ASTERN

which can be performed by hand in the event of the failure of the pneumatic gear—the camshaft is set for the desired direction of running, say ahead; the scavenging pump valve links are set similarly by the weight-shaft seen in the fore front of the engine illustrations; the starting valve rods are lifted over the ahead cams; and the movements automatically performed by the first wheel are complete. When the second wheel is turned, the two top shafts in line carrying the rockers of the valves are rotated to bring the starting valve rod rollers down on their cams, and air is thereby admitted to the cylinders in turn. A further turn of the wheel lifts two of the starting valves out of action, and the rotation of the top shaft and sets the starting valve rods over the astern cams. The second wheel then performs the same sequence of movement as previously described. The whole of the operations are achieved automatically. A further control over the running of the engine is given by the little hand-wheel at the side of the two maneuvering wheels, the turning of this serving through an appropiate connection of rods and links to advance or retard the fuel valve rollers and so alter the period of opening of the injection valve. A governor is fitted on the end of the camshaft to operate direct on the fuel pumps on the slightest increase of maximum speed.

Balance levers drive the pumps for the various services, the drive being of air may be required for maneuvering. In these little engines the frame is built in two parts and is of box form, strengthened internally by columns. They are enclosed by light steel plates. On the cylinder heads are the starting, inlet fuel, and exhaust valves, operated through vertical rods by cams mounted on a shaft enclosed in the frame. The fuel pumps are driven direct by the crankshaft, and there is an adjustable governor which works by the general method of lifting the inlet valves of the fuel pumps. The oil pump for the forced lubrication is cast in one with the fuel pumps.

The remainder of the machinery of the ship consists of an electrically-driven ballast pump, delivering 120



INBOARD PROFILE OF THE MONTE PENEDO

tons per hour; a 10-H. P. steam engine, which can be coupled to a dynamo or to a compressor; a steam-driven ballast pump delivering 40 tons per hour; a donkey boiler housed on deck and serving to supply steam for the deck machinery, as also for the steering engine when nearing port—at other times the steering is worked by compressed air at 105 lbs. per sq. in.—a boiler feed pump; and a fuel pump which supplies the same sort of fuel to the donkey boiler as is used in the main and auxiliary Diesel engines. About 650 tons of fuel is carried in the bunkers forward of the engine room.

The Howaldtswerks at Kiel, who constructed the ship, and Sulzer Bros. of Winterthur, who built the engines, have done their work well. The trials were very brief, and a fortnight after the first run the Monte Penedo left Hamburg on her first voyage to South America. It is anticipated that she will be diverted from her intended service in order to evade the high price of fuel oil in Europe at present, and that she will accordingly call at some United States ports.

Launch of Collier Middlesex

The New York Shipbuilding Co., Camden, N. J., launched on Sept. 2, the steel collier Middlesex for the Coastwise Transportation Co., Boston, Mass. The Middlesex is of the following dimensions:

	Ft.	In.
Length between perpendiculars	377	4
Beam, molded	50	
Depth, molded	32	
Draught, loaded	25	
Cargo carried at this draught, tons	7,250	
Gross tonnage, tons	4,730	
Speed at sea, loaded, knots	10	

The vessel has a single deck of steel, with poop 80 ft., bridge 17 ft., and forecastle 34 ft. long, seven steel watertight bulkheads, two pole masts, straight stem and semi-elliptical stern. A deep double bottom is fitted all fore and aft for the carriage of water ballast, and particular attention has been paid to the construction of this part of the vessel; the plating being of extra strength and fitted flush; no wood ceiling is fitted. The five cargo holds are entirely clear of beams and pillars, the deck being supported by deep arched beams and web-frames placed midway between the watertight bulkheads; a continuous trunk, 24 in. deep by 30 ft. wide, is carried on the upper deck for the full length of the cargo space. Large steel cargo hatches are in the top of this trunk, 11 in all. Six steam winches are fitted in connection with five pairs of king posts for raising the hatch covers and securing them in place when open. A cargo boom is located on the fore mast for handling stores, etc. The coal bunkers are at the sides of the vessel in the boiler room and in the poop 'tween decks, with hatches on the poop deck and pockets leading to the fire-room. The peaks are both arranged as water-ballast tanks. The accommodations consist of a midship deckhouse on the bridge deck for the captain's stateroom and spare room, with a pilothouse over; the saloon officers' and petty officers' berths, pantry, toilet, etc., are in the bridge; the engineers, cooks, steward, messrooms, refrigerator, toilets, galley, etc., are in the houses on the poop deck, and the oilers, seamen and firemen are berthed in the poop abreast the engine casing.

The steam windlass is fitted with warping ends and located on the forecastle deck, with the engine below in forecastle. The steam capstan is on the after end of the poop deck, with the engine below. The steam steering gear is on the upper deck abaft the engine casing, with connection to the steering stations in pilothouse and on navigating bridge; auxiliary hand-steering wheels are also provided. The propelling machinery is placed aft, and consists of one triple-expansion, inverted reciprocating engine of about 2,100 I. H. P., and two single-ended Scotch boilers having a working pressure of 175 lbs. The vessel is intended for the coastwise coal-carrying trade between Baltimore and Boston. Loading and discharging gear is not fitted on board, the two terminal points being arranged with these facilities.

Johnson Iron Works

The Johnson Iron Works, Ltd., New Orleans, La., are building a sternwheel towboat to be known as the Mariano Escobedo. The hull is of galvanized steel, 87 ft. long, 24 ft. beam and 4 ft. deep. The engines are fore and aft compound, 7½ and 15 by 36 in., surface condenser, with independent air and circulating pumps. The boiler is of the firebox type, supplied with independent feed pumps and injector. The boat will have accommodations for twenty passengers, the cabin being finished in mahogany. The company is also building a steel sternwheel towboat for the United States Mississippi River Commission, 116 ft. long, 28 ft. beam and 5 ft. deep, fitted with fore and aft compound engine, 12 and 26 by 32 in., with jet condenser, three horizontal boilers, externally fired, duplicate feed pumps and injectors and electric light plant.

Naval Collier Orion

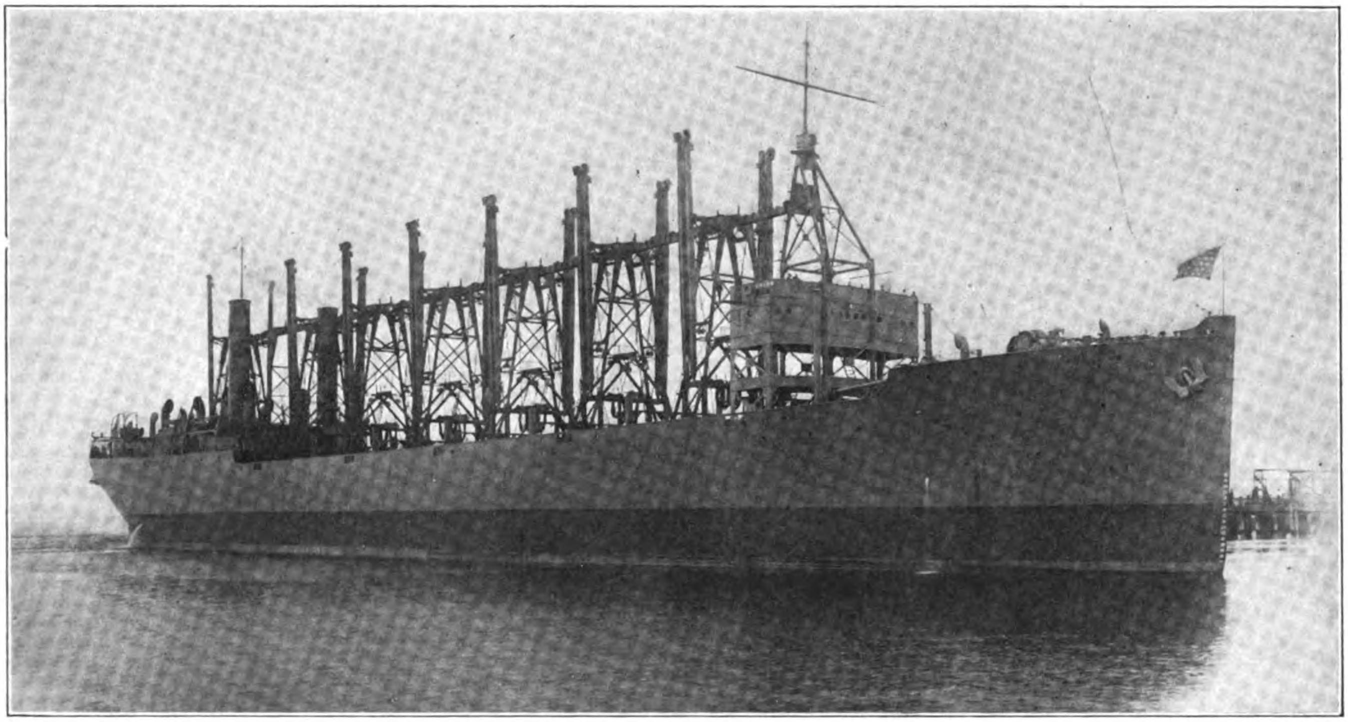
Description of a Vessel Which Was Constructed in Record Time by the Maryland Steel Co.

THE elapsed time from the laying of the keel to the launching of the collier Orion for the United States navy at the yard of the Maryland Steel Co., Sparrows Point, Md., was five months and 17 days. The vessel was completed in nine months and three days, a very creditable performance.

The Orion, like her sister, the Jason, now nearing completion, has an overall length of 536 ft., length from forward side of stem to after side of rudder post 514 ft., beam molded 65 ft. and depth molded of 39 ft. 6 in. The vessels are classed A-1 for 20 years under the American bureau of shipping.

The Orion is built on the Isherwood patent system of longitudinal construction, with the propeller machinery in the stern. The cargo is carried in six large holds, which are clear of stanchions and by means of the topside tanks the coal is self-trimming. Five holds are fitted with two hatches each, and the forward one with but one hatch. Forward of the cargo holds under the lower deck are four deep tanks for carrying cargo fuel oil. The inner bottom under holds is also fitted for cargo oil and with the deep tanks has a combined capacity of 772,400 gallons. The topside tanks extend the length of the holds, and are for water ballast only. The feed water is carried in the inner bottom under the engine and boiler rooms. The coal bunkers have a combined capacity of 2,246 tons and are fitted at each end and over the boiler room with a reserve bunker on the berth deck outboard of engine room casing. The coal bunkers were designed with special attention towards eliminating trimming. A trimming tank is built between the after peak tank and after engine room bulkhead. Two domestic tanks of 20 tons total capacity are carried on lower deck aft of engine room.

The contract requirements of handling 100 tons of coal out of each hatch per hour created such enormous stresses that a decided departure from the usual mast and booms was necessary, and the builders decided that the same design of coal-handling apparatus they developed for the collier Neptune would be satisfactory. The builders' wisdom in regarding this problem strictly as a coal-handling proposition and not as a matter of appearance, was borne out when the operator handled over 137½ tons of coal per hour at the official test. This test took place upon the completion of the 48-hour run at the Norfolk navy yard, the operator raising the bucket to a specified height and distance outboard of the collier's side. The coaling booms are of built-up type, and are designed for handling continuously a working load of 7,500 lbs. under service conditions. To handle all the buckets, 24 Lidgerwood winches are installed, two of which are of special design with double drums for operating the fore and aft trolley.



NAVAL COLLIER ORION

The deck machinery is composed of a Hyde steam pump brake windlass with two gypsy heads fitted for warping, and engines located on deck below. A Hyde capstan is fitted aft on the poop deck with cylinders enclosed in base. The steering gear is a Hyde right and left screw gear type, fitted with three wheels of hard wood for hand steering, and operated by a steam steering engine controlled by telemeter operated from bridge.

The crew of 152 men are carried in 'tween decks forward and aft and twenty-five officers are quartered in deck house on poop deck. The crew's

quarters are finished in red cypress, the officers' and captain's quarters and dining saloon in white pine and white oak. Mess rooms and warrant officers' quarters in white pine and red cypress. Bridge house in red cypress and white oak. Trim in galley, pantries and bakery of ash. Screen doors and windows are fitted in officers' quarters. Venetian doors to inside of all entrances to officers' quarters. Steel bulkheads are fitted around showers, water closets, pantries, galley, bakery and lavatories.

The floors of the galley, bakery and pantries are covered with a non-porous tile, officers' lavatory with white vitrous tile and the crew's lavatory with asphaltum cement. Linoleum is laid in walking spaces of crew's quarters and necessary spaces and throughout in petty officers' quarters, hospital and officers' quarters.

Fowler & Wolfe radiators are installed throughout the ship, with system drainage through trap to filter box or condenser. Two Sturtevant direct-connected generating sets of 25 kilowatt capacity are installed for lighting the vessel, and operating a 24-in. searchlight. Inter-communicating telephones are installed in captain's room, on lower bridge, aft on poop deck, chief engineer's room and engine room. The wireless apparatus has a radius of 200 miles.

A feature that was observed on the Orion was that the deflection due to the load was 71 per cent less than that observed on the collier Neptune under similar conditions. The deflection taken from the above percentage was the maximum in both ships and was taken at the same point. The cargo on both ships at the time the deflection was read was 10,500 tons of coal, 2,000 tons of bunkerage coal, 120 tons of feed water and 130 tons of stores and crew.

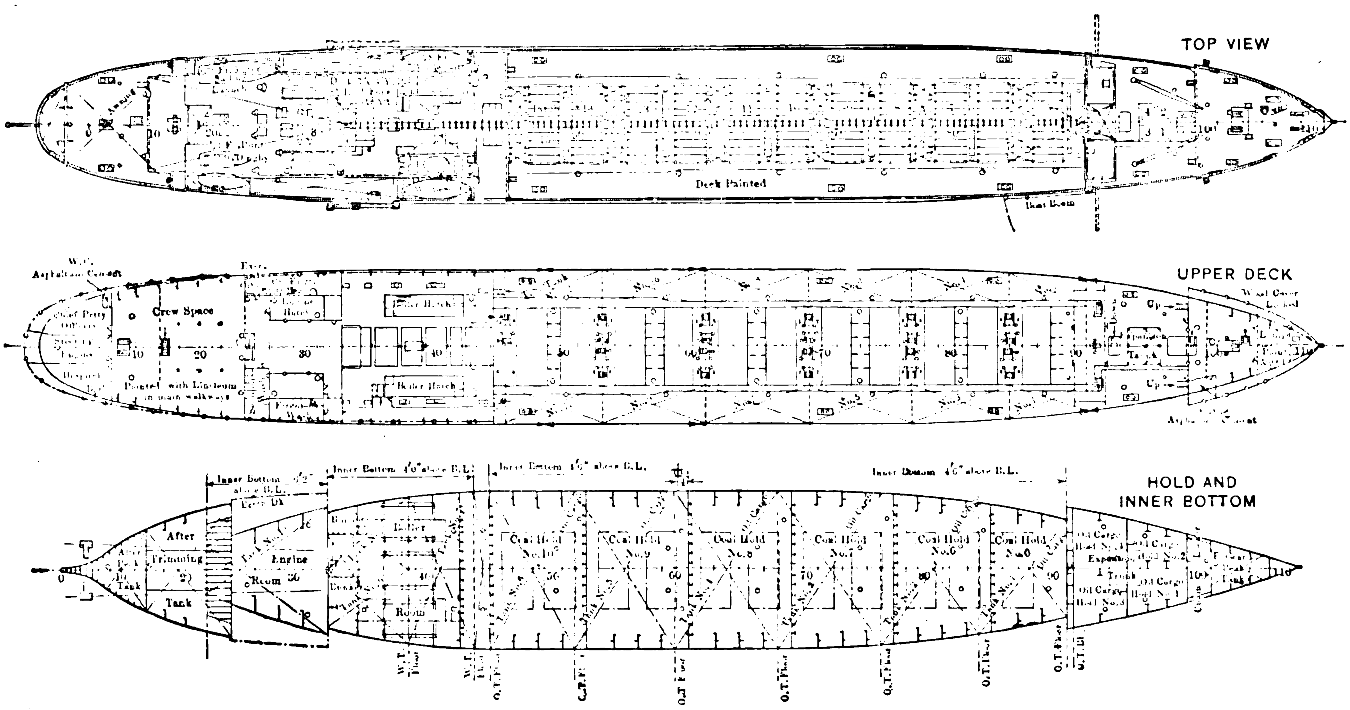
Propelling Machinery

Due to saving in weight of structure resulting from the use of the Isherwood system, the Orion carried the specified deadweight on a draught of 26 ft. 10½ in. in place of 27 ft. 7⅝ in. as required by contract. This saving means an increase in deadweight of over 500 tons, or an additional earning capacity of 4 per cent on the same initial cost and the same operating expense.

The propelling machinery of the Orion represents the highest class merchant type. The two main engines were designed with special reference to economy and are of the three-cylinder, triple-expansion type. The cylinders are 27, 46 and 76 in. in diameter by 48-in. stroke, designed for a working pressure of 200 lbs. per square inch. All cylinders are fitted with piston valves. The crank shaft is 14¾ in. in diameter in two pieces. One main air pump, two bilge pumps and an oil pump for forced lubrication to thrust block, are direct connected to each main engine. The main condensers are independent of the main engine framing and are located just outboard of each main engine.

As the machinery is in the stern there is only one length of line shaft. The propellers are of the three-bladed built-up type, with cast steel hubs and manganese bronze blades. They are 16 ft. 6 in. in diameter and 18 ft. mean pitch and the trials of the Orion demonstrated that these wheels admirably suited the required conditions.

There are three double end Scotch type boilers operating under the Howden's system of forced draft. Each boiler is 15 ft. 10½ in. mean diameter by 21 ft. 4 in. long and contains eight 40-in. inside diameter corrugated furnaces. The total heating surface is about 18,900 sq. ft. A donkey boiler 8 ft. diameter by 10 ft. 4 in. long constructed for 200 lb. working pressure and located in bunker between engine and fire rooms, is provided for port use.



SECTIONAL DRAWINGS OF THE NAVAL COLLIER ORION

The usual number of auxiliary machines have been provided consisting of two 14-in. centrifugal circulating pumps, three long stroke simplex feed pumps, a duplex fire pump, sanitary and fresh water pumps, two large evaporators with pump, two distillers with pump, an auxiliary condenser with attached pumps for port use, a pressure type feed water heater, two forced draft fans and a two ton refrigerating plant. As the double bottom carries cargo oil or ballast there are two duplex pumps in engine room cross connected to either service.

The 48-hour endurance trial run of the Orion which was started July 10, 1912, proved very successful, the ma-

chinery running smoothly throughout and showed the following results:

Revolutions per minute, average both engines, 95; average steam pressure at boilers, 195 lbs.; average steam pressure at engines, 192 lbs.; average air pressure in ash pit, 1 in. water; average indicated horsepower both main engines, 6,943; average speed for run, 14.468 knots.

Tug Richard Fitzgerald

The Chicago Lighterage Co., of Chicago, have had turned over to them recently the new harbor tug Richard Fitzgerald, named for the president of that company, and her attractive appearance is drawing a great deal of attention about the Chicago river. The principal dimensions of the Fitzgerald are: Length overall, 92 ft., beam 22 ft., and depth 12 ft.

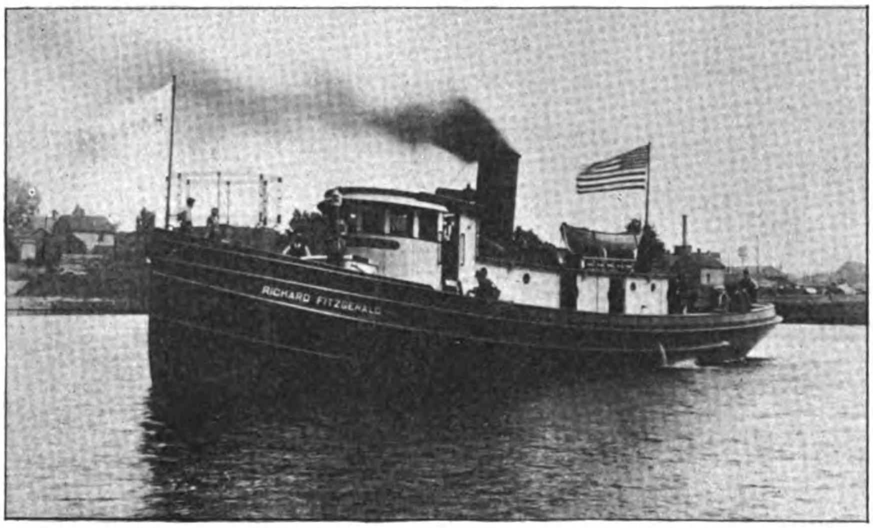
The tug is built completely of steel, exceptionally heavy in all parts, and designed for particularly hard service. The frames are heavy and close spaced, and the lightest shell plating is 3/8 in. thick. The water line strake is doubled practically the full length, making a belt 3/4 in. thick. Where the bow plating is not doubled the plate is 1/2 in. thick, as is also the shear strake. A deck stringer 1/2 in. thick runs completely around the boat. The balance of the deck is 1/4 in. blind punched to insure a foothold.

The deck house is steel throughout, flush riveted and 4-in. pilasters divide the surface into panels. The pilot house is ceiled in yellow pine and contains a large seat and two lockers. The engine room is ceiled throughout, as is also the forward and after holds. A galley, completely equipped, is in the forward hold, and the sleeping quarters, with steel berths, are in the after hold.

The rudder is very heavy with a 7-in. stock and double cast steel tow posts are installed aft and a single post forward.

The power plant consists of a fore and aft compound condensing engine with cylinders 18 and 38 by 30-in. stroke, swinging an 8 x 9 in. cast steel wheel.

The stern tube is cast iron and has a removable bronze bushing in halves, filled with lignum vitae, arranged for easy removal. This is the same type of tube that is used on large ships. An independent jet condenser is installed and the other auxiliaries consist of a main feed pump, a pony pump, and a heater. The exhaust steam is led into the hot well, heating the feed water before it is passed through the heater, giving the highest possible temperature for the feed water. All valves are operated from the handling platform and the engine room is fitted up with a full set of gages, mounted on a board. The latest type of Metropolitan injector is installed. An automatic relief valve in the exhaust pipe allows atmospheric exhaust in case the water supply is choked up by ice or other matter.



THE TUG RICHARD FITZGERALD

The boiler is a Scotch marine type, 13 ft. diameter by 12 ft. 6 in. long, carrying 180 lbs. of steam, and is fitted with three 42-in. Morison furnaces. A 6-in. ash gun is installed in the fireroom. An athwartship coal bunker and two side bunkers give ready access to the coal and hold a supply of 55 tons.

The steering gear is the Elmes type, located in the engine room and operated by a lever in the pilot house.

The electric light plant has sufficient capacity to light all parts of the boat, including the running lights. In every way the Fitzgerald is completely equipped with all the outfit and accessories necessary for a first-class tug.

The Fitzgerald was designed and built by the Manitowoc Shipbuilding & Dry Dock Co., at Manitowoc, Wis., and this company is now working on a tug of the same size for a Milwaukee company.

Oil Burning Steamers

Some 250 steamers have been recently adapted for burning oil-fuel, the largest being Toyo Kisen Kaisha liners Tenyo Maru and Chiyo Maru, of 13,454 tons and 13,431 tons respectively. The new Cunard liner Aquitania, of 50,000 tons, in course of construction on the Clyde, is to be similarly equipped, while a White Star boat, of 18,000 tons, which is now being built at Belfast for the Cape and Australia route, and which is to be named the Ceramic, is also to use oil. Quite a large number of oil-burners are now employed in the Pacific; two of them, the Ventura and Sonoma, recently inaugurated a service for the Ocean Steamship Co. between San Francisco and Sydney, New South Wales. Another line of steamers burning oil-fuel, the Crown Line, will soon be running between Pacific Coast ports and Australia. The Southern Pacific is also converting all of its steamers into oil burners.

Hendricks' Commercial Register

The twenty-first annual revised edition of Hendricks' Commercial Register of the United States has just been issued. This is a compilation of architectural, engineering, electrical, mechanical, railroad, mining, manufacturing and kindred trades and professions. It is intended to establish a direct link between the buyer and seller. The total number of classifications in the book is over 50,000, and there are upwards of 385,000 names and addresses. All manufacturers of a particular trade are first classified under a general heading for mailing purposes, and then each firm is published under as many classifications as every variety of their products call for. The book contains 1,419 pages, with an elaborate index of 122 pages. It sells for $10. S. E. Hendricks Co., 74 Lafayette street, New York, are the publishers.

The steamer John A. Hooper, building for Sudden & Christenson, of San Francisco, Cal., was launched at the yard of the Harlan & Hollingsworth Corporation, Wilmington, Del., on Sept. 23. The Hooper is 300 ft. long, 44 ft. beam and 21 ft. deep.

Motor-Driven Ship Christian X

The First Deisel-Engined Vessel to Reach New York—In the Hamburg-American Line Service—Visit to Her Engine Room

THE motor-driven ship Christian X of the Hamburg - American Line, attracted a great deal of attention at New York last month. She was built and engined by Burmeister & Wain, of Copenhagen, for the East Asiatic Co., but was purchased by the Hamburg-American Line upon her arrival at Kiel. Her original name of Fionia was then changed to Christian X. While at Kiel she was visited by the kaiser, and is the first Diesel-engined ship to fly the German flag.

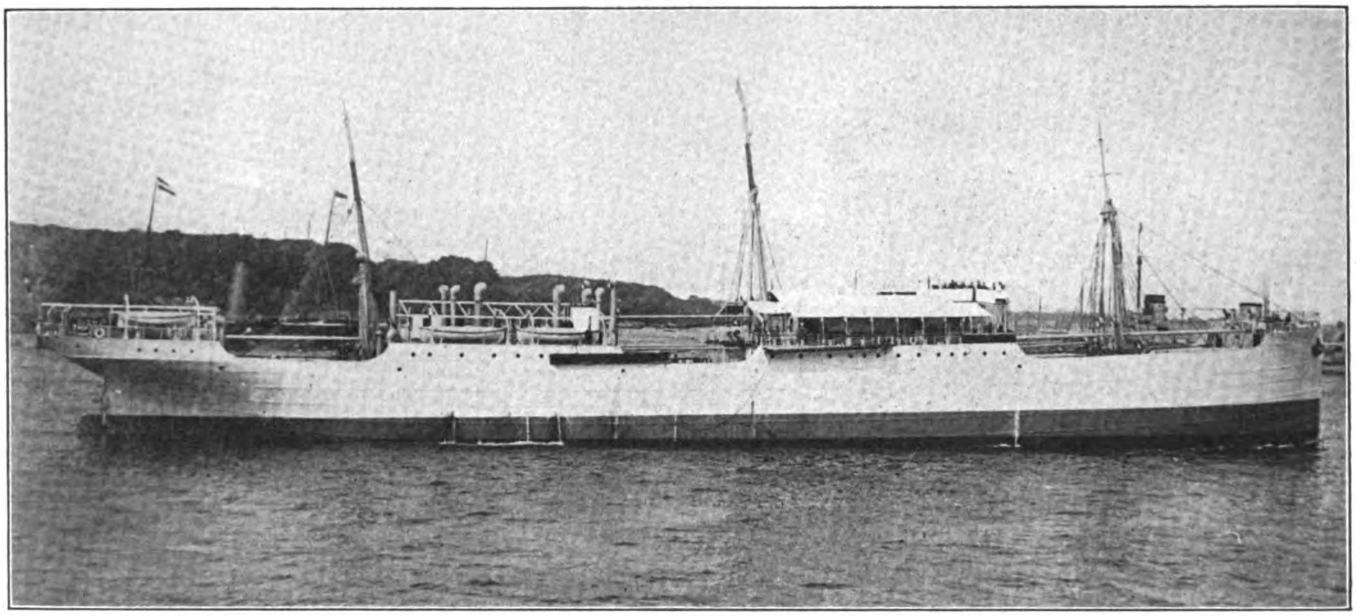
Christian X is 386 ft. long, 53 ft. beam, 30 ft. deep, with a draught of 23 ft. 6 in. Her deadweight carrying capacity is 7,400 tons. Her total horse power is 2,500, which is developed by two sets of Diesel engines of the four-cycle type, each having eight cylinders.

On the way across Capt. Robert Niss says that he was queried by nearly every ship as to what he had done with his smoke stacks. The new vessel has no funnels, the gases of combustion passing through apertures in the upper part of the mainmast and the smoke from the galley fires through the mizzen mast, both being constructed of hollow steel.

John J. Bogart, consulting engineer to the New York Engine Co., visited the ship at Hoboken and writes very entertainingly concerning the vessel, as follows:

"The steamship requires recoaling four times to circle the globe if she carries coal in her bunkers. The oil ship circles the globe with what she can carry in her double bottom. A fuel consumption of between nine and ten tons for each day of 24 hours at full speed, when fully loaded, makes possible for the Christian X, which has just completed 12,000 miles, a continuous voyage around the world without replenishing her supply. Over 900 tons of oil can be run into her tanks lying wholly below the cargo space. A steam engine ship would consume between 40 and 50 tons of good steam coal per day of 24 hours, would require bunker space above the level of the fire room floor, would require coal trimmers, firemen, and water tenders, all of whom are dispensed with in an oil-engine ship. Considering that this was a maiden voyage, considering the prodigious distance traveled, that this type of propelling machinery has no more than 10 years experience behind it, that the engine force of ten men and three boys had no opportunity to acquire previous experience at sea with the Diesel motor engines, the results attained are surely remarkable.

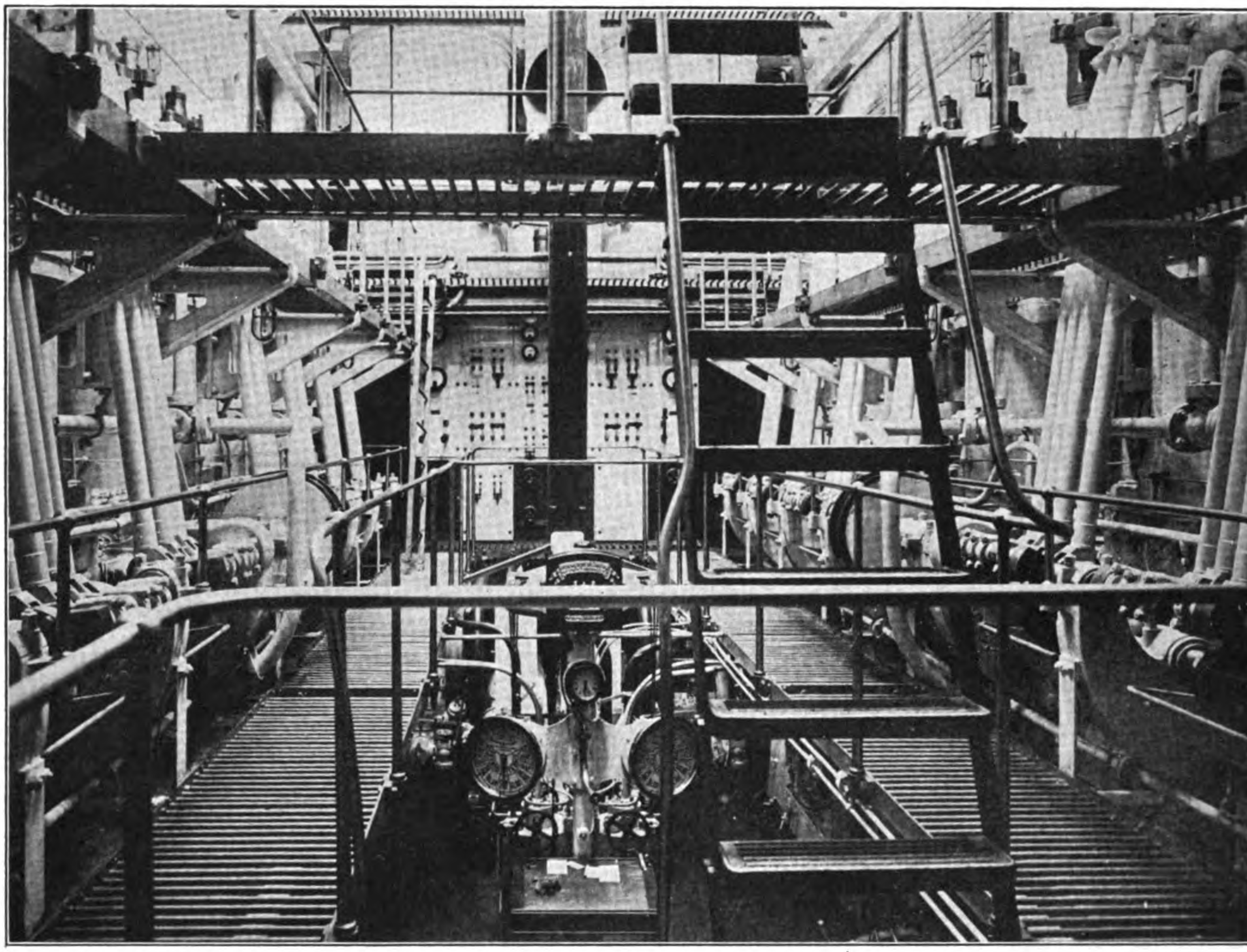
"Through the courtesy of the resident manager of the Hamburg-American Line, and in company with a representative of the United States navy, I was kindly permitted to study the working and details of the machinery of the Christian X, being in the engine room from the time the ship left the dock at Hoboken till she slowed down near the lightship to discharge her pilot. Let the layman picture to himself four enlarged automobile engines, coupled together in pairs, driving two propeller shafts, and he will get a faint idea of what the main engine installation looks like.



THE HAMBURG-AMERICAN MOTOR-DRIVEN LINER CHRISTIAN X

Each of the 16 power cylinders is about four times as large in diameter as the largest automobile cylinder he is familiar with—or, to be more exact, 20⅞ in. in diameter. The stroke of all the 16 pistons is 28¾ in. and the total horsepower indicated at sea under normal conditions is very nearly 2,500.

"Of course, these are not gasoline engines, but fuel oil engines, and utilize what is left of petroleum after the gasoline and kerosene have been removed by distillation. Gasoline is unsuitable for marine power plants. The volatile nature of gasoline makes any leak from pipes or tanks extremely dangerous, while residual oil is safe from the possibility of forming an explosive mixture with air. So for reasons of safety as well as economy the



ENGINE ROOM OF THE HAMBURG-AMERICAN MOTOR-DRIVEN LINER CHRISTIAN X

heavy, non-volatile petroleum distillates are alone suitable for the production of power at sea.

The Marine Steam Engine

"There are many other points to be considered before one can be bold enough to contemplate the relegation of marine steam engines to the scrap heap. When launched the Christian X bore the name Fionia, and was one of three motor ships ordered from Messrs. Burmeister & Wain of Copenhagen, the other two being the Selandia and the Jutlandia, all three being engined with Diesel oil engines of Messrs. Burmeister & Wain's own design, Denmark taking the lead of all Europe in the production of a 10,000 tons displacement motor ship, engined with upward of 2,500 I. H. P. of oil engines when ships of about half the size and half the power only had been turned out by other builders.

"The Selandia was the first one of these motor ships to be put in service, and a considerable amount of information relating to her performance on one of her regular voyages of 21,840 miles is now available.

"A careful inspection of the engine room log of the Christian X, which the chief engineer of that vessel so kindly placed at my service, convinced me that this motor ship is in every way the equal if not the superior of the Selandia. The Selandia belongs to the East Asiatic Co., and it was from them that Herr Ballin, so well known for his enterprise, bought the Fionia for the Hamburg-American Line after having witnessed her successful trials at Kiel during the latter part of June of this year. During the Selandia's maiden voyage out to Bangkok and return she stopped at 16 ports, encountered practically all kinds of weather, and all hands aboard ship appear to be a unit in declaring that she proved herself thoroughly reliable and free from those troubles that usually crop out with a new ship and new engines. Twice on the voyage the pistons were withdrawn to examine the rings and the cylinder walls, and twice on the voyage the valves were taken out and examined. No cylinder wall was found scored or worn, one or two of the piston rings needed a little paraffine to free them and the exhaust valves, which have cast iron heads on steel stems, in a few instances needed cleaning and refitting.

Selandia's Performance

"There is a little matter of at least $350 per month saving in food and wages for the fireroom force. An oil-engined ship is more expensive to build and equip than a steam-engined ship. In the case of such 10,000-ton vessels as the Selandia and Christian X, the difference is as much as $50,000. The East Asiatic Co. of Copenhagen, the concern for whom these two vessels were built, estimated that there would be a saving of some $25,000 per annum for each ship if engined with Diesel motors in place of steam engines. Each ship is supposed to make three round trips or voyages from Copenhagen to the Far East via the Suez canal in that time. They calculated also upon a gain of 1,000 tons in cargo space, which represented to them not less than $5,000 per voyage, or $15,000 per ship per annum. If the calculations of the owners are correct the extra cost of these 10,000-

ton motor ships will have been earned and written off within 18 months.

"Reversing from full ahead to full astern takes some 20 seconds, and the tanks for holding compressed air are of sufficient capacity to permit the starting of an engine 30 times or both engines 15 times without renewal of the supply. Two four-cylinder Diesel oil engines of 250 H. P. each drive electric generators that furnish the electricity needed to light the ship and operate all the auxiliaries, including the steering gear. A donkey boiler furnishes steam to a small steam engine that is directly coupled to a Reavell compressor if by any possibility the need for such a service should arise. Because 16 separate complete engines make up the two main engines, the carrying of spare parts is greatly simplified. An extra exhaust valve for each cylinder, because it is considered good policy to change these details every 20 days, is the most noticeable spare part.

"Altogether the impression made on me from my sojourn in the engine room during the short time that elapsed between leaving the dock in Hoboken and discharging the pilot off the lightship was distinctly favorable, and a careful perusal of the engineer's log disclosed conditions in sea service that strengthened the conviction that marine history is being written by the advent of the Diesel engine."

Marine Gas Engines

Holzapfel I, the first sea-going gas-driven vessel, which resumed her work in April last, has since completed ten voyages in the coasting trade, and these have been performed without accident. Her last voyage terminated in the Tyne in the early part of August. Although the work performed during the present year was quite satisfactory, the owners have come to the conclusion that the general arrangements of the vessel are such as to militate against her continued successful working. The gas plant and donkey boiler were placed on the engine room flooring, and the heat and dirt from these were such as to make the work of the engineers in the engine room very difficult and uncomfortable, and the owners have now come to the conclusion that the only correct place for the gas plant is in a separate space above the water line. One of the reasons why the gas producers were placed below the water line had been in order to have a 'tween deck bunker, from which the coal could be fed into the producers automatically by gravitation, and, while this worked in quite a satisfactory manner, the position of the producers was so cramped that stoking and clinkering could not be efficiently carried on.

The space on deck in which the owners propose to place gas producers, etc., in future, will be considerably less cramped, and will make all these operations quite easy. Special ventilating arrangements for the space in which this plant is contained will also be made. Unfortunately the Holzapfel I is so constructed as to make an alteration of this nature practically impossible, particularly as to raise the gas plant above the water level would probably reduce her stability below the safety margin, and the owners have consequently decided to take out the machinery and to sell the hull. The vessel has in all performed 19 voyages since she was built, and has shown what are the difficulties in the adaptation of gas plant and gas engines for marine purposes. A valuable lesson has been learned by her working, and it is sincerely to be hoped that this will not be lost, but that other vessels will soon be built, profiting by the experience of the past and giving further and unquestionable proof of the economy, efficiency and safety of marine gas engines.

Two Oil Fishing Schooners

On the Pacific coast of Canada, the long, narrow reaches of the inside route from Seattle and Vancouver to the halibut grounds off the coast of Alaska have made the sails of the fishing schooners employed in the halibut industry an almost useless part of their equipment during the major portion of their trips. To overcome this difficulty, many of these boats are equipped with auxiliary power; but it has remained with the New England Fish Co. to take the longest step forward in the industry. This firm's headquarters are at Boston, but they have important offices in New York, Seattle, Vancouver and Ketchikan, Alaska.

They are now having built at the yards of Arthur D. Story, in Essex and Gloucester, Mass., two sister schooners of a modified knock-about type, 125 ft. over all, 102 ft. load water line, 24½ ft. beam, with a mean draft of 10 ft. to be powered with two 100 H. P. Blanchard oil engines, operating twin screws, and developing a speed under power alone of about 10½ miles an hour. They will have plain pole masts with no top masts, and the sail area will be cut down to 4,500 sq. ft., less than one-half that with which boats of this size would be normally equipped. Briefly, the sails are to be used only as auxiliaries to the engines, which are a late development by the Blanchard Machine Co. under the direction of Wolcott Remington. They are of particular interest in that they will use for fuel a low grade, asphaltum base oil that is put out by the Standard Oil Co. on the Pacific coast as Star fuel oil. It costs only a dollar a barrel in Seattle, and its high-flash point makes it as safe as coal.

It is planned to launch the two schooners in October, and after the engines have been installed and the rigging and outfitting completed, they will proceed to Seattle via Cape Horn, arriving there in time for the early spring work.

The schooners were designed by Thos. F. McManus, of Boston. He has been prominently connected with the New England fishing industry for 14 years, 13 years as an active participant and the remainder as a designer of fishing schooners, and in that time has built and designed over 300 vessels.

The original type of fishing schooner was shallow draught with long bowsprit and jib boom and very long main boom, giving it a long sail base line extending far outboard, making the work of handling sails in heavy weather exceedingly dangerous. In fact, the chance of wreck in storms was one of the most serious that fishermen of those days took; but now all this has been changed, and the production of Mr. McManus, several years ago, of the knock-about type with its deep and sharp hull lines, short sail base, and eliminated bowsprit have made these boats safe and easy to handle in heavy seas. There is less pitching and great saving of wear and tear on the rigging, no bobstays to leak, no bowsprit to loosen, and with practically no overboard work for the men to do in handling sails; they now fear only fog, collision and shore.

On the Pacific coast the need for this step has been imperative and the results achieved by these vessels will be watched with interest, not alone there, but on the Atlantic coast as well, for the increasing need of power is being strongly felt by the Boston and Gloucester fishermen, as a delay of a few hours in landing at T wharf may mean a decrease of hundreds of dollars in the price they obtain for their catch.

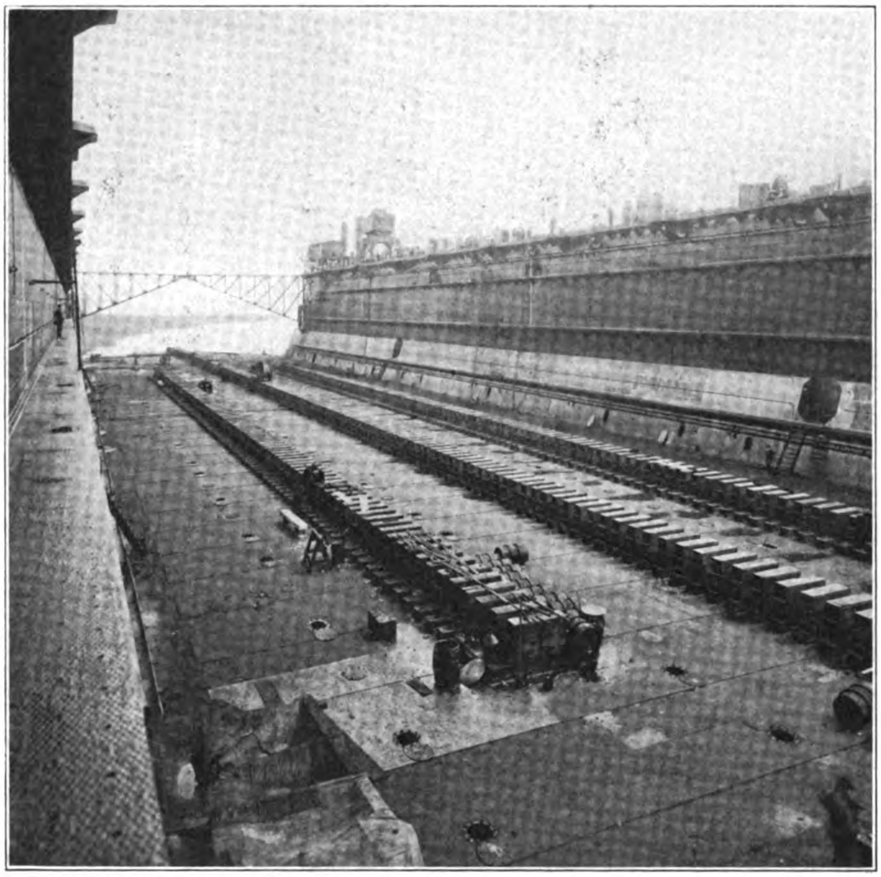
The Chesapeake Steamship Co. has awarded contract to the Maryland Steel Co. for two freight and passenger steamers for service between Baltimore and Richmond.

Two Great Floating Docks

The Enormous Structures Which Have Recently Been Turned Out in British Yards for the British Admiralty

EARLY this year Swan, Hunter & Wigham Richardson launched this great floating dock from their Wallsend yard. A great deal of interest has been taken in the dock, not only owing to its being designed to lift battleships for the British admiralty, but also because of its exceptionally large size, some idea of which may be gained when it is known that the dock covers an area of two and a quarter acres. Messrs. Clark & Standfield of Westminster were consulted in the preparation of the designs, their reputation for floating docks of all types being known in every quarter of the globe.

Of the floating docks built in the United Kingdom, the majority have been turned out from the Wallsend ship yard of Swan, Hunter & Wigham Richardson, who have executed orders for the British admiralty, the governments of Natal, Southern Nigeria, Japan, and Spain; and also for numerous foreign clients in various parts of the world. During this year Swan, Hunter & Wigham Richardson have delivered three floating docks to the British admiralty, one for raising torpedo boat destroyers, another for docking submarines, and the great Medway battleship dock, herewith dealt with. The over-all dimensions of the Medway floating dock are 660 ft. long and 144 ft. wide. The clear width between the rubbing timbers at the top deck is 113 ft. The side walls are 66 ft. high on the outside of the dock and 46½ ft. above the pontoon. In length they are 520 ft. along the pontoon deck and 440 ft. at the top. The depth of the pontoon is about 20 ft. The weight of steel plates and angles worked into the dock is about 12,000 tons. The dock is designed to lift battleships of displacements up to 32,000 tons with a draught of up to 36 ft. The keel blocks of English oak are spread over a length of 640 ft. and the two lines of bilge blocks at each side cover a length of 280 ft.



VIEW OF MEDWAY DOCK FROM PORT WALL PLATFORM LOOKING FORWARD

The dock is of the so-called "box" type with two side walls. On the double bottom or pontoon proper there are two hollow walls running almost the full length of it. These side walls are permanently attached to the pontoon so that the dock cannot be taken to pieces in any way. This is roughly the difference between a "box dock" and docks which are "self-docking". The latter are so constructed that they can be detached in sections so that one part of it can be raised by the remainder of the dock for purposes of repairing, cleaning and painting. At the bow end of the dock there is a pair of flying gangways of lattice construction giving access from one wall to the other.

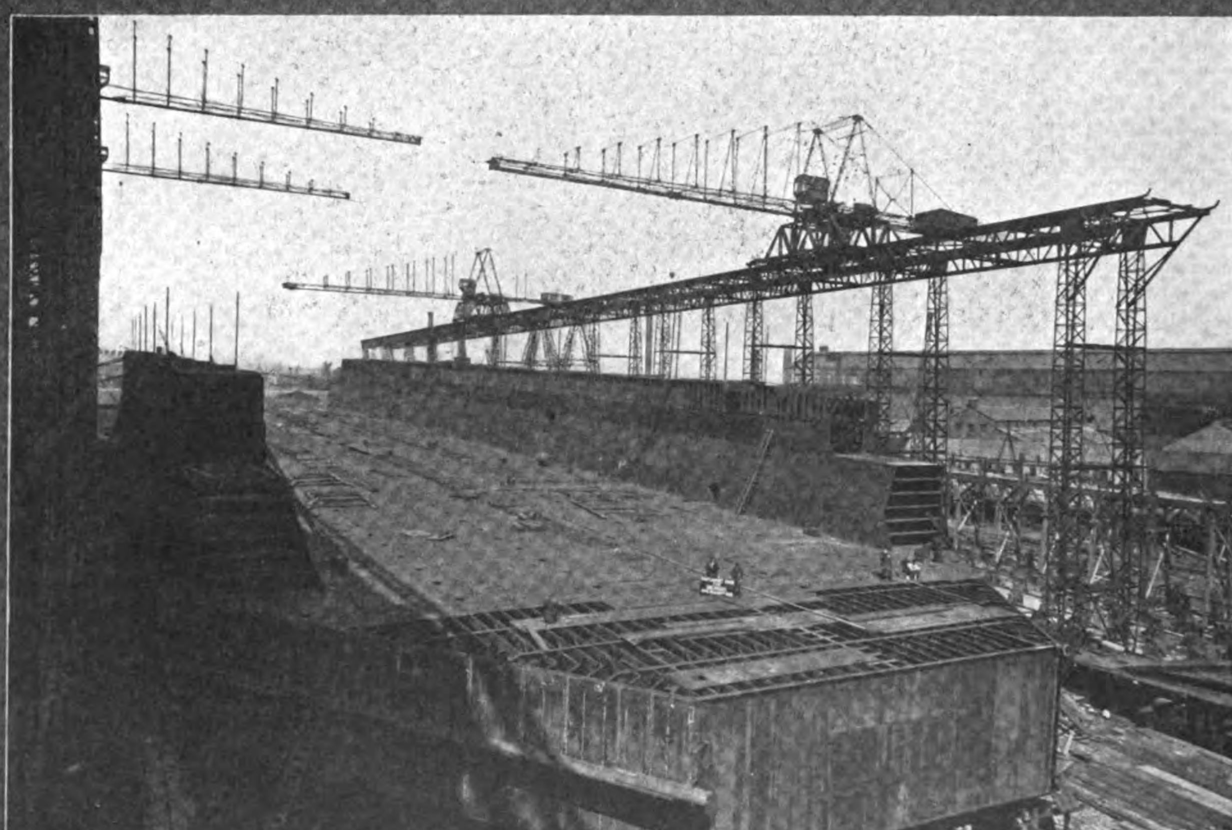
The mooring attachments are unusually large and strong so as to efficiently hold the dock in a tide-way. At each end of each wall there is a strong timber roller fender to help to guide vessels when being docked. The valve house is placed at the forward end of the starboard wall and from this point all the valves and pumping arrangements of the various compartments of the dock are controlled. In the valve house are two long tables on which are fixed a large number of pressure gages giving the height of water in the various compartments of the dock. The gear for operating the valves is on the Westinghouse electro - pneumatic system.

The bottom pontoon is divided both longitudinally and transversely by a number of watertight bulkheads, and the two side walls each have a watertight deck running their whole length. These bulkheads and decks divide the pontoon and walls into about 80 watertight compartments. These are grouped into sections, each of which has its own sets of valves so that it can be flooded or emptied independently.

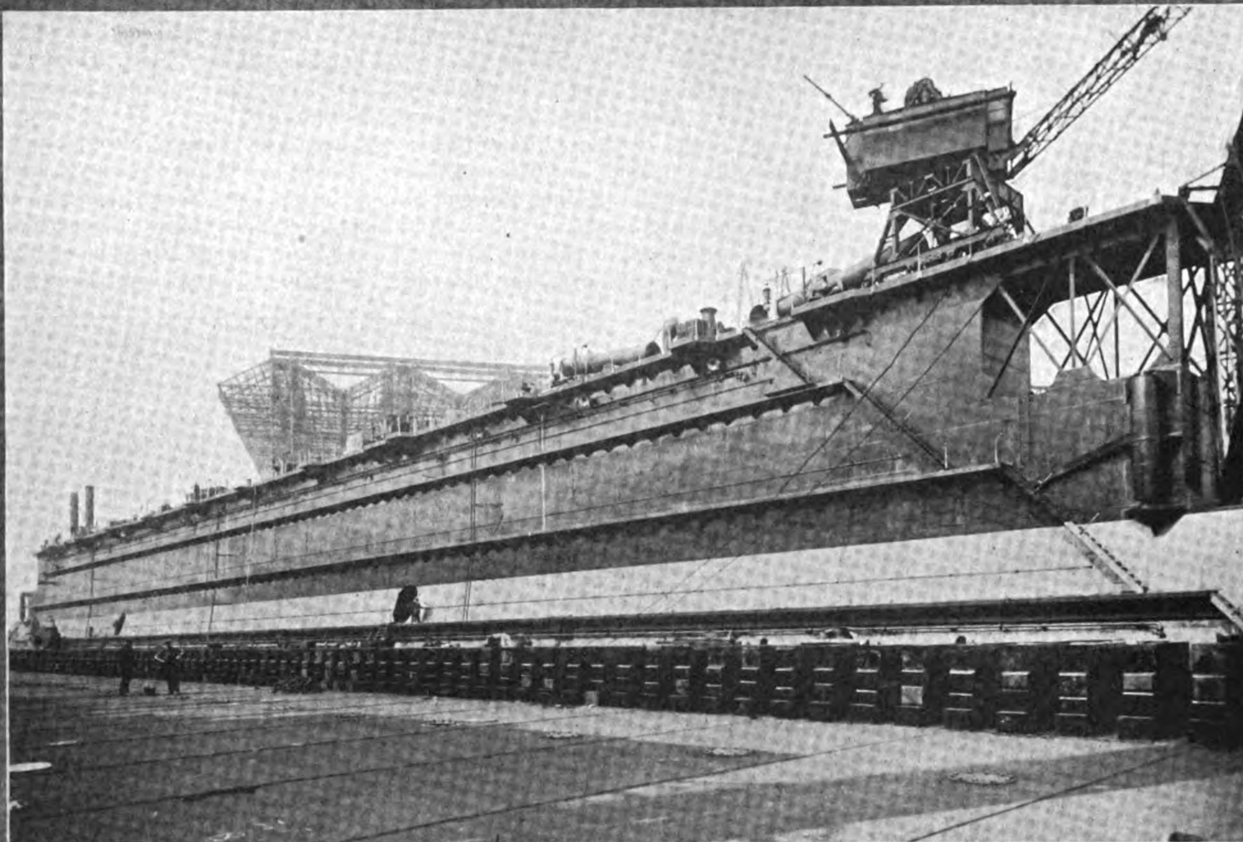
Living accommodation, mess rooms, lavatories, etc., have been provided in the port wall for the dock master, petty officers, and dock crew.

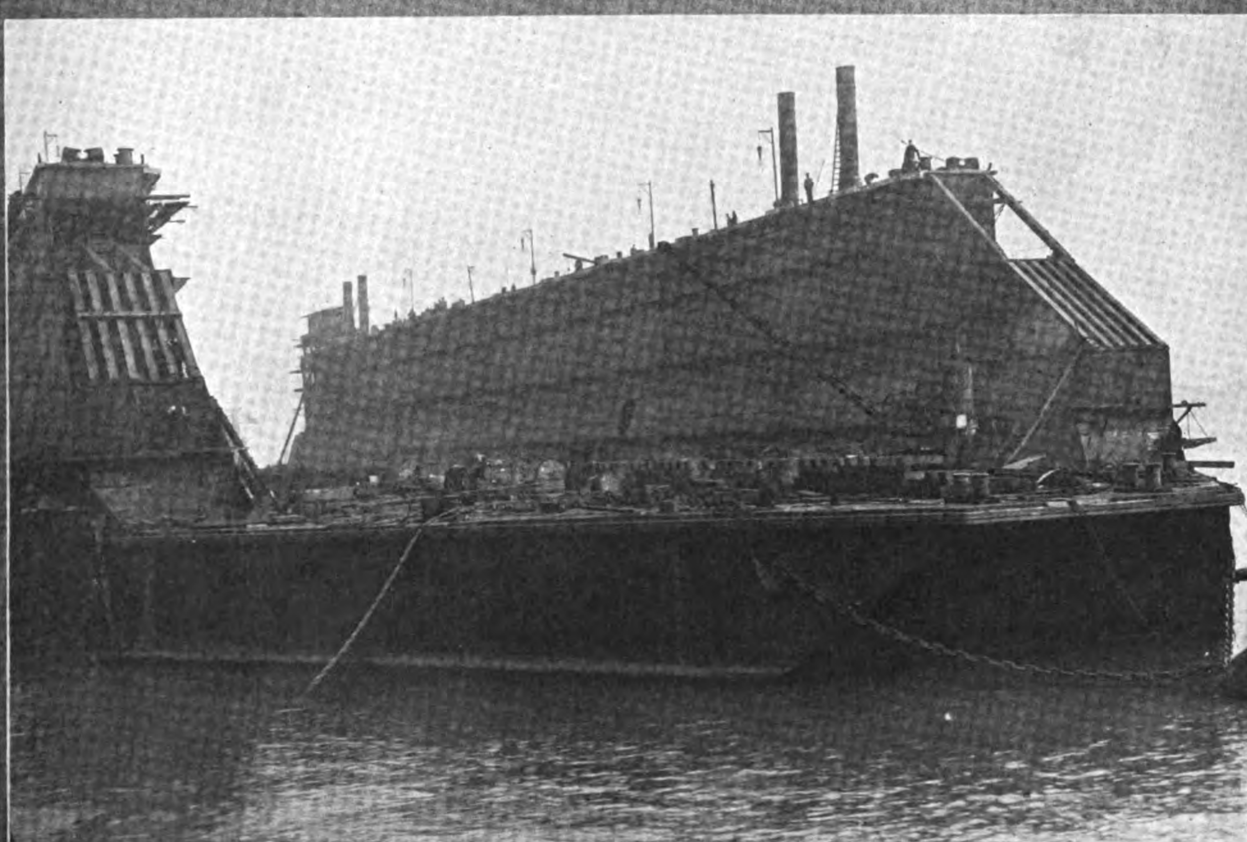
At each end of each wall there are two steam boilers, making eight in all, which were built at the Neptune works of Swan, Hunter & Wigham Richardson. These boilers have a working pressure of 155 lbs. per sq. in.

The installation of pumping machinery comprises eight compound condensing engines driving centrifugal pumps at 275 revolutions per minute.



THE UPPER PHOTO GIVES A GENERAL VIEW OF THE MEDWAY DOCK ALONGSIDE THE WALLSEND SHIP YARD. THE LOWER PHOTOGRAPH SHOWS THE BOTTOM PONTOON PRACTICALLY FINISHED AND SIDE WALLS BEING ERECTED





THE TOP PICTURE SHOWS THE PORT WALL OF THE MEDWAY DOCK FROM THE INSIDE OF THE DOCK, SHOWING PLATFORMS, TRAVELING CRANES, ETC. THE BOTTOM PICTURE SHOWS THE DOCK JUST LAUNCHED, WITH TEMPORARY HEAVY TIMBER STRUTS TO TAKE LAUNCHING STRAINS

In each wall are also placed two direct acting steam pumps capable of delivering four hundred gallons of water a minute and these are used for fire and wash-down services.

On the top of each wall is a five-ton electric traveling crane with separate motions for revolving, hoisting, derricking, lowering, and traveling. Eight powerful steam driven capstans are fitted on the walls to warp ships into position. In each wall there is a dynamo room with high speed steam engines driving Westinghouse direct-current generators. Electric current is used for lighting, operating the valve gear, driving traveling cranes, and also the machinery in the workshops. Furthermore, power and light are to be provided for any warship that may be in the dock. In the starboard wall there is a fine range of workshops, comprising a forge, a lathe shop, machine shop and coppersmith's shop. They are all well equipped with a number of tools, such as high speed lathes, boring and drilling machines, punching and shearing machines, an electro pneumatic power hammer, an hydraulic bending machine, planing machines, and forges.

In the walls of the dock there is also air compressing plant to provide power for the electro-pneumatic valve operating gear and also for a large complement of pneumatic tools.

From the foregoing it will be seen that this new admiralty dock represents the most efficient and complete means of overhauling and repairing battleships of the largest and most modern type.

The Portsmouth Dock

The great dry dock built by Cammell, Laird & Co., Birkenhead, Liverpool, for the British admiralty was successfully floated on Aug. 14, and safely delivered at the Portsmouth dock yard on Aug. 21.

The dock has been specially designed to accommodate the heaviest of our battleships and cruisers, having a lifting capacity of 32,000 tons.

It is unlike other floating docks on account of the structure being continuous for its whole length, with the side towers permanently attached to the pontoon, and is described as a box type dock, whereas the usual type is self-docking; this means that the pontoons are constructed in detachable sections so that each pontoon may be raised alternately for the purpose of examination and repair.

Displacement of 49,000 Tons

An idea of the great dimensions of the dock may be better appreciated when it is stated that the area of the bottom of the dock exceeds 2¼ acres, the overall dimensions being 680 ft. long and 144 ft. wide. The clear width at the top of the side towers is 113 ft. The side towers are 66 ft. high from the bottom of the pontoon and 45½ ft. above the pontoon deck level.

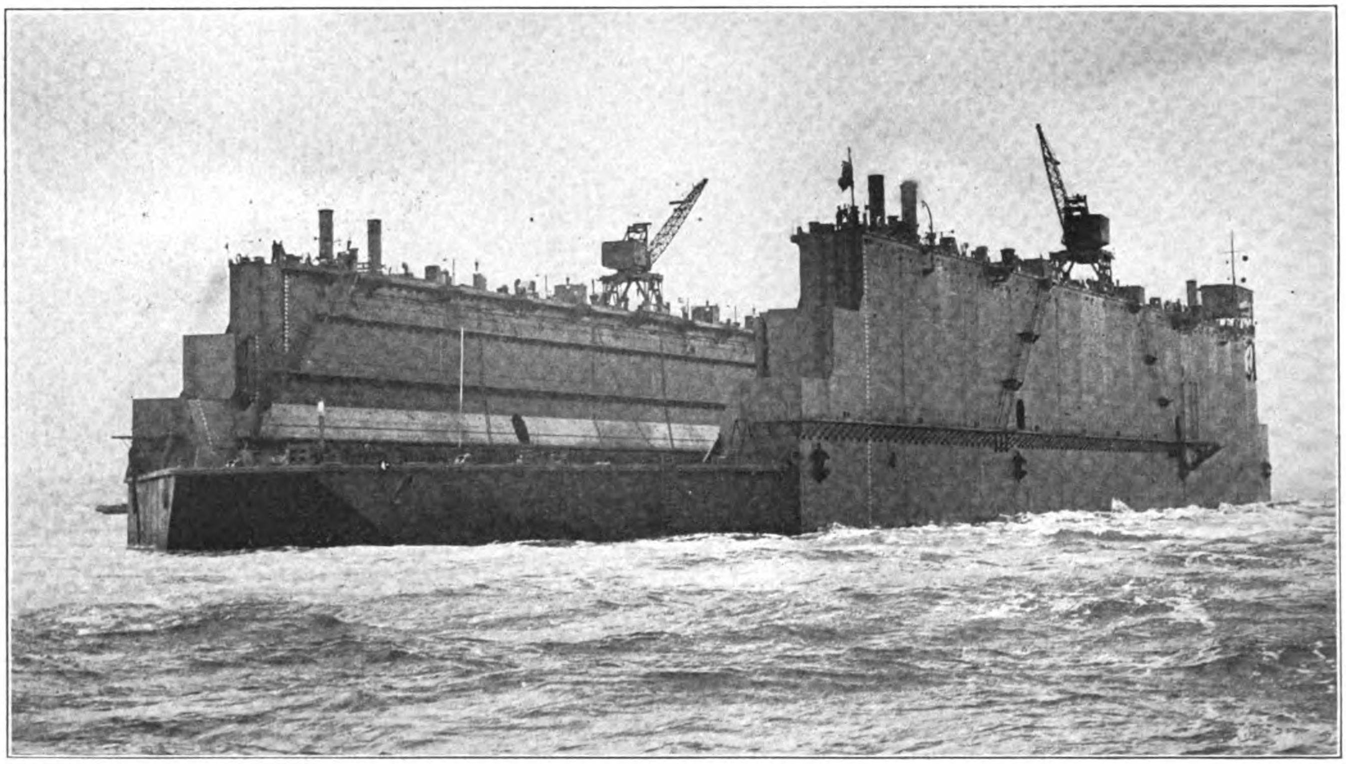
The total displacement of the dock when submerged to dock a ship having a draft of 36 ft. is 49,000 tons. The pontoon and side walls at the bottom of the dock are divided by transverse and longitudinal watertight bulkheads into 80 compartments. These are grouped into sections, each section having its own set of valves, so that any compartment can be floated and emptied independently.

The complete control of the dock is arranged in the valvehouse, where a table carrying a model of the dock indicating the separate compartments is fitted. Each compartment shown on the model has its own gages for indicating whether valves are open or closed and the depth of water in feet in each compartment.

For the former purpose the well-known Westinghouse electro pneumatic system is installed. It is based on the principle of operating presses by compressed air, and controlling the same from a distance by means of valves operated by electro magnets.

The positions of the valves are indicated back to the valve table by electrical means.

Each watertight compartment of the dock is provided with water level indicators in the valvehouse model. These indicators are in the form of an inverted cup in the bottom of each compartment. From the top of these cups or bells a pipe is led through the interior of the dock up



TOWING THE GREAT 32,000-TON DRY DOCK FOR THE BRITISH ADMIRALTY TO PORTSMOUTH HARBOR

to the valvehouse, where the pieces are fitted, one end of which is connected to an aneroid gage capable of reading by pressure from a 6-in. head of water to the highest head that can occur in the compartments.

The other leg of the tee communicates with a receiver pipe common to all indicators in the block, and such are governed by a small plug valve.

The receiver pipes are connected to a small air reservoir fitted with a hand pump. The pumping machinery is arranged in two identical installations, and situated one in the port and the other in the starboard wall, and is capable when combined of emptying the dock of water and lifting a vessel drawing 36 ft. and of a displacement of 32,000 tons within five hours.

The Pumping Machinery

The steam power for driving the main pumping engines and dynamos is supplied by eight watertube boilers, with a working pressure of 155 lbs. per sq. in., constructed at the works of the builders. Two of these boilers are arranged near each end of each side wall.

The pumping engines consist of eight compound condensing engines, each driving a set of centrifugal pumps of Messrs. Gwynnes' make. These are of the horizontal vertical spindle type, and are seated directly on top of the main drain running along the bottom of the walls.

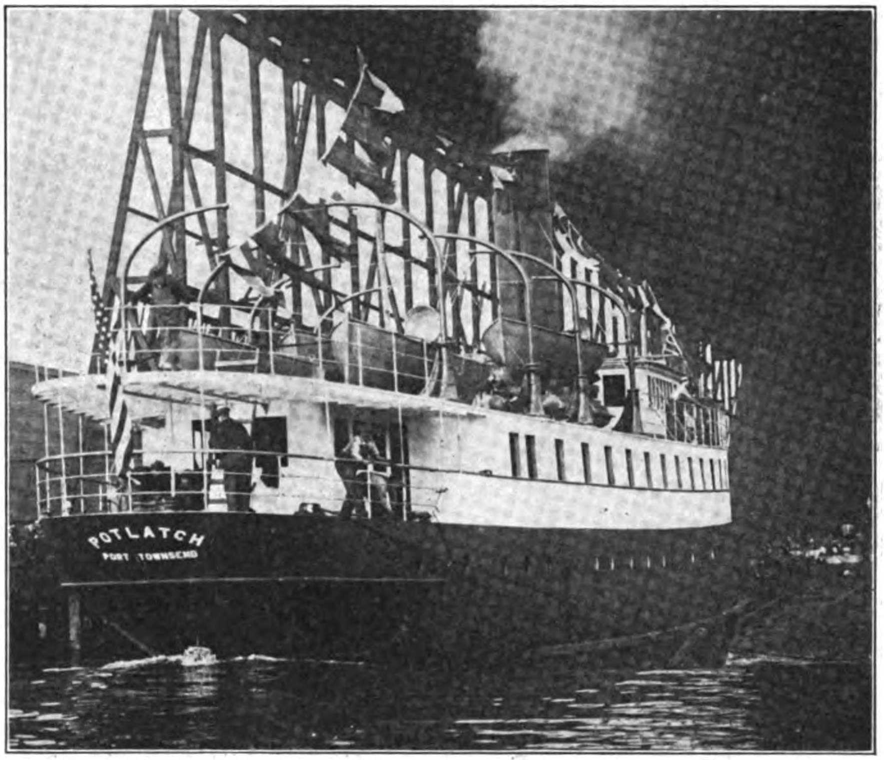
Two direct acting steam pumps are placed in the condenser room for fire and wash-down service, the suction of these pumps being connected to the main drain of the dock so that they may be used as a drainage service for emptying any one particular compartment.

A dynamo-room is provided in each wall. This equipment of electrical machinery supplies current for driving the machinery in the workshops, the traveling cranes, the valve gear, and for lighting, etc., through flexible conductors. Power and light are also supplied to any warship that may be in the dock. In each wall of the dock there has also been placed an air compressor, providing power for a complete equipment of pneumatic tools, and also for actuating the electro-pneumatic valve operating gear.

In the starboard wall there is a fine range of workshops. These include a coppersmith's shop. These workshops contain a number of fine tools, such as high-speed lathes, boring and milling machines, and electro-pneumatic power hammer, a flanging machine, punching and shearing machines, forges, an hydraulic pipe-bending machine, and planing machines. In the port wall living accommodations, including mess-rooms, lavatories, etc., has been provided for the dockmaster, petty officers, and dock crew. On the top of each wall there is a 5-ton electric crane. These cranes have separate motions for traveling, revolving, derricking, hoisting and lowering. Eight powerful steam-driven capstans, supplied by Messrs. Harfield, are placed on the walls for warping ships into position.

Launch of the Potlatch

What is certainly the fastest piece of construction work ever done on Puget sound culminated in the launching of the steel passenger steamer Potlatch, at the yards of the Seattle Construction & Dry Dock Co. The Potlatch is an Indian name, meaning an annual feast and gathering of the tribes. The vessel was about 95 per cent completed when she was launched and as she went down the ways there was steam in her boilers, as shown in the accompanying photograph. The Potlatch blew herself a welcome with her own whistle.



LAUNCHING THE POTLATCH WITH STEAM UP

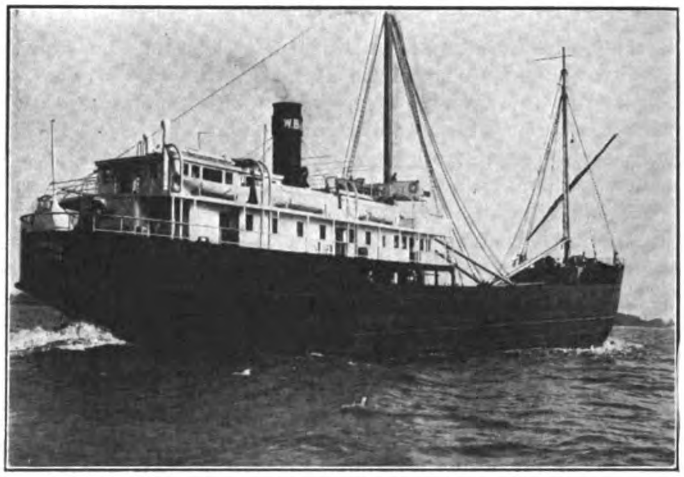
The dimensions of the Potlatch are: Length over all, 158 ft.; length between perpendiculars, 150 ft.; breadth, 27 ft.; depth, 8 ft. 9 in.; indicated horsepower, 750; contract speed, 13 knots. The vessel is equipped with a triple-expansion engine, two Seabury water-tube boilers and burns fuel oil, as do practically all steamers on Puget sound now. The Potlatch has twenty-eight state rooms and accommodations for sixty-two passengers.

The building of the Potlatch adds another unit to the fleet of the Inland Navigation Co. Two years ago President Joshua Green, of this company, announced that as the old wooden steamers outlived their usefulness, they would be replaced by fast and commodious steel vessels. Four vessels have been added since—Kulshan, Sioux, Sol Duc and Potlatch, all built by the Seattle Construction & Dry Dock Co.

The Seattle Construction & Dry Dock Co. will build two more steel vesels for the Inland Navigation Co., work having already been started. One of these will be the Tacoma, for the Seattle-Tacoma route. The Tacoma, whose dimensions will be 221 ft. over all, beam 30 ft. and depth 10 ft., will be built to a contract speed of 19 knots. She will be a day boat, and will have no staterooms. Her machinery will consist of a four-cylinder, triple-expansion engine and Ballin water-tube boilers. The second steamer, to be known as the Sockeye, will be a freighter.

The Alaska Pacific Steamship Co. has purchased the steamer Admiral Farragut from the American Mail Steamship Co., and will place her on the Tacoma-San Francisco route next spring.

Steamer Columbia



Constructed by the Harlan & Hollingsworth Corporation for the Pacific Coast—Equipped to Burn Oil—General Description of Her Hull and Machinery—Now En Route to the Coast

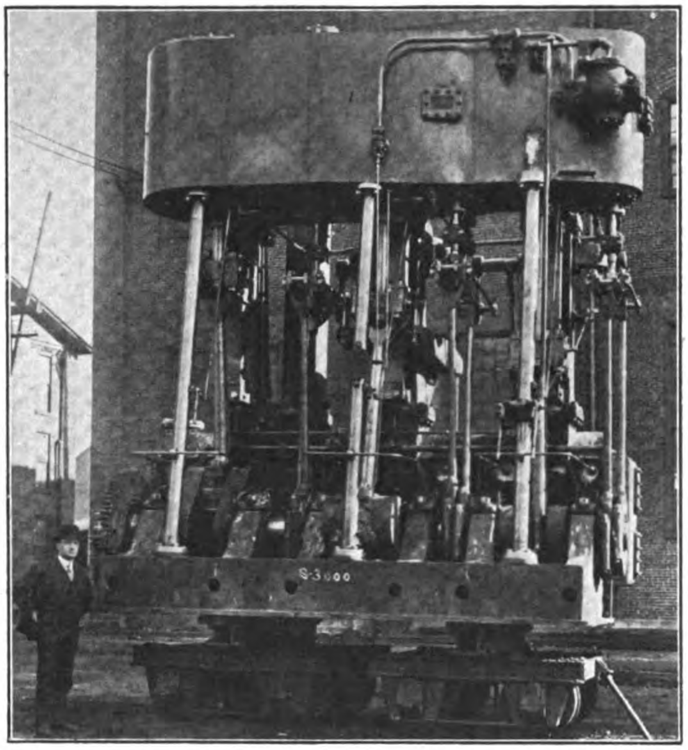
THE Harlan & Hollingsworth Corporation, Wilmington, Del., recently completed for Wilson Bros. & Co., San Francisco, the steamer Columbia, and she has now left for the Pacific coast. The dimensions of the Columbia are:

	Ft.	In.
Length over all	251	
Keel	243	3
Beam	41	
Depth to main deck	20	

The vessel is built of steel and is classed by the American Bureau of Shipping. The double bottom is on the cellular system with floors on every frame. The framing above tank is reinforced by web frames, beams are fitted to every frame, and main deck is completely covered with steel and pillared by H bars. The double bottom and forepeak are constructed for carrying oil fuel, fresh water being carried in tanks under engines and in after peak. The vessel is divided transversely by three watertight bulkheads. She has one hold, served by two large hatches, 28 ft. x 14 ft., on the main deck. The Columbia has a forecastle and long poop and is rigged as a two-masted schooner, the masts being of steel. Each mast carries two booms, each of which is capable of lifting 7 tons. The foremast carries a cross yard and square sail, also a leg-o'-mutton sail, and main mast is rigged with a storm sail. The mast and boom rigging is exceptionally heavy, all shrouds, stays and cargo running gear being steel wire and blocks of Boston & Lockport make in steel shells. Chain lashings with turnbuckles and slip hooks are provided so that the vessel may carry a deck load of lumber. Two powerful winches are fitted at each mast. They are of the vertical type manufactured by the Union Iron Works, San Francisco, Cal.

The vessel is fitted with a steam windlass. Steam warping capstan and steam steering engine are of, Hyde make. The steering engine operates a pinion through a friction device which absorbs all shocks. The pinion meshes directly with a geared quadrant on rudder stock. The hand steering gear operates the quadrant in a similar manner. A powerful towing engine is located in a house on the poop deck. This machine is of the Shaw-Spiegle type, built by the American Engineering Co.

The crew are housed in the forecastle; the steerage and waiters are in the poop. The mess room, cold storage rooms and engineers' rooms are also in the poop. Passenger accommodation is in a house built on the poop deck at fore end of which is the dining saloon with pantry and galley abaft same, the latter having communication with bakery by stairway. All of the staterooms with the exception of two are outside rooms, having inside doors so that passengers may reach dining room without going outside. There are three berths in each room, and all the furniture is of oak. A sitting room is provided for passengers and a smoking room in plain oak, both being located on boat deck, access to which is obtained by inside stairway. The poop deck is sheathed with heavy pine and with boat deck forms a promenade for passengers. The officers' quarters are in deck house at fore end of boat deck and immediately abaft the pilothouse. These rooms are finished in oak. The captain's room is paneled in oak and has door opening to pilot house. The pilot house is fitted with a navigating bridge overhead, the bridge being carried out to the side of the ship.



TRIPLE-EXPANSION ENGINE OF THE STEAMER COLUMBIA, PHOTOGRAPHED JUST PRIOR TO INSTALLATION

The propelling machinery consists of one triple-expansion, surface condensing engine with cylinders 19, 30 and 50 in. diameter with a stroke of 36 in. The high pressure and intermediate pressure cylinders have piston valves, while the low pressure cylinder has a double-ported slide valve. The condenser is built in with the frame of the engine. The valve gear is of the Stevenson link type. A steam reversing gear is installed and water cir-

culation is provided for all bearings. The air pump and two bilge pumps are attached to back of condenser. Ths independent pumps, made by the Fairbanks-Morse Co., are the main and auxiliary feed, donkey and fire, bilge and deck, sanitary, salt water and fresh water pumps.

Steam is supplied from two single-ended Scotch boilers, 12 ft. diameter by 11 ft. 6 in. long, each boiler having three furnaces and allowed 180 lbs. pressure. A vertical donkey boiler, 4 ft. 6 in. diameter by 9 ft. high, is located on main deck. Settling tanks are built in boiler room in connection with fuel oil systems. One oil tank pump and two oil fuel pumps are installed. The system of supplying oil to furnaces for combustion and arrangements of burners require no steam or compressed air for atomizing the oil, and is known as the Dahl patent oil burning system, manufactured by the Union Iron Works, San Francisco. This system was described in the August MARINE REVIEW. The steamer is lighted throughout by electricity by two General Electric generators, one of 13 K. W. and one of 6.6 K. W. capacity being installed.

A 12-ton capacity evaporator is installed for making up fresh water losses and also a vertical multicoil feed water heater, both of Griscom-Spencer Co. make. A 1-ton refrigerating plant of Vulcan Iron Works make is installed for cooling provisions and supplying ice water. She is also fitted with a wireless telegraph apparatus.

The Columbia can carry 2,117 gross tons cargo, 4,228 barrels of fuel oil and 94 tons of fresh water on a draught of 18 ft. She has accommodations for 50 first-class and 15 steerage passengers, and carries a crew of 30. On her trial with ballast tanks forward the vessel made a mean speed of 11 knots and developed 1,200 I. H. P.

She left the Harlan & Hollingsworth yard in command of Capt. C. E. Allen with Chief Engineer P. Concannon in charge of the mechanical end.

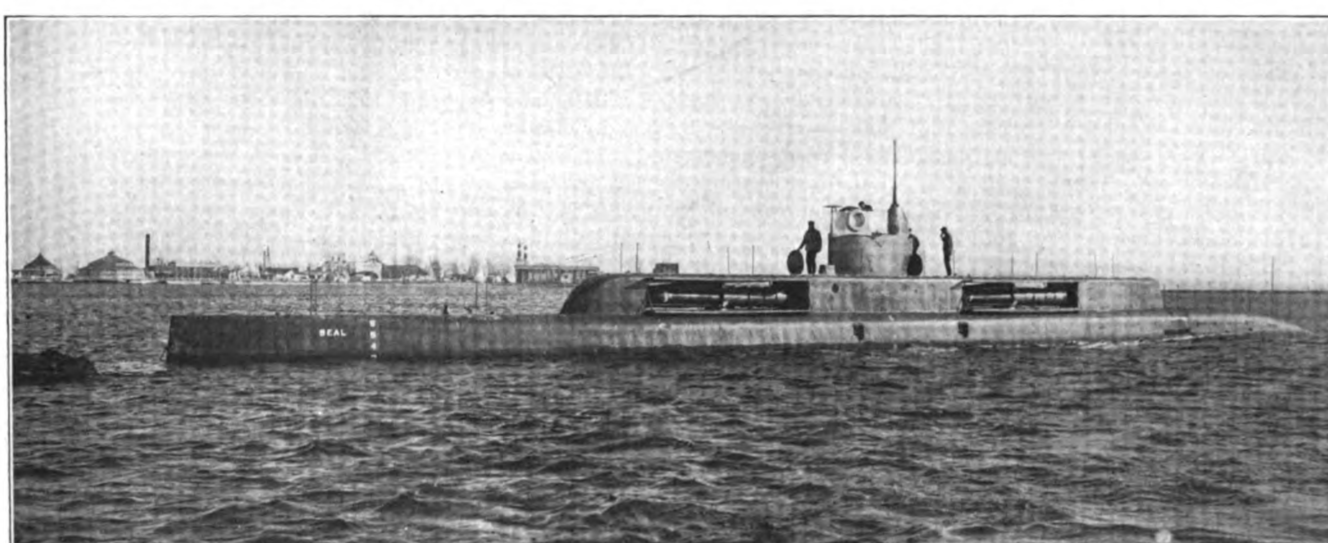
Submarine Torpedo Boat Seal

The First of the Lake Type to be Built for the United States Navy—Some Results of Her Trials

THE submarine torpedo boat Seal or G-1, as she is now known, built by the Lake Torpedo Boat Co., Bridgeport, Conn., recently completed her acceptance trials off Provincetown, Mass. Her trials consisted of numerous tests to prove her speed and endurance machinery, strength of hull to resist pressure, tests of firing torpedoes while submerged, ability of the crew to leave the vessel while submerged, means of communicating with the surface while submerged and ability to remain at rest while submerged.

The Seal was the first of her type to be built for the United States navy and under the terms of the contract, payment was to be withheld until she had satisfactorily concluded all tests.

The contract price was $450,000, but there were various penalties attached, such as $15,000 per knot for failure to make contract speed, $500 an hour for failure to carry a certain number of hours fuel supply at 14 knots speed, $500 a minute for failure to submerge in light condition while running at 14 knots to submerged running at 8 knots in more than 6 minutes' time; $100 a second penalty for failure to reverse from full speed ahead in less than 10 seconds while running at 14 knots; $1,000 an inch for failure to secure a metacentric height of 15 in. when submerged.



BROADSIDE VIEW OF TORPEDO BOAT SEAL

The function of the ordinary submarine is simply to fire torpedoes. They are carried in the bow tubes and the vessel must be steered towards the target. The Seal carries not only bow tubes, but also deck tubes in a superstructure. Side doors are opened in this superstructure and the torpedoes being located in revolving torpedo tubes, the torpedoes may be trained either to broadside, the same as any ship's gun, or as they are trained in a surface destroyer. The design permits of the discharge of torpedoes while the vessel is at

rest submerged. The Seal is also fitted with wheels for navigating on the bottom.

In her tests the Seal exceeded every contract requirement. Her contract surface speed was 14 knots; she made 14.7 knots. Her contract speed submerged was 9½ knots; she made nearly 11 knots, and at a speed of 5 knots she can run continuously submerged for over 125 miles. At a speed of 8 knots she can make a voyage of over 4,000 miles on the surface and over 2,500 miles semi-submerged.

The contract called for her to be able to discharge batteries while navigating under one engine; the trials showed that she could discharge batteries at the normal rate under one engine, and be navigated at the same time at a speed of over 10 knots with the other engine.

One of her trials was to proceed submerged at a speed of 9½ knots over the measured mile during which period the depths should be maintained at 3 ft. She was run submerged at early 11 knots, and the depth did not vary at 2 ft. and at 9½ knots the depth over the course was maintained within 1 ft.

Balancing submerged at rest she was held at a depth of approximately 65 ft. for 10 minutes, while with the use of her fore and aft anchors she can remain submerged at rest at any desirable depth up to 200 ft. for two or more days, if necessary. The contract called for her to be submerged to a depth of 200 ft. and to remain submerged at that depth for a period of 10 minutes. It is usual in such tests for submarines to be lowered by means of a derrick without any one in them, but in the case of the Seal, Capt. Sloan Danenhower took her down to a depth of 256 ft. with her own crew.

As a final test Capt. Danenhower also dove out of the door in the diving compartment to show how readily the crew could escape from the Seal if she should become disabled and unable to be brought to the surface.

After her tests she returned to Bridgeport for painting, preliminary to her delivery to the Brooklyn navy yard. Lieut. Kenneth Whiting will command her.

Deckloads of Lumber

Why the Attempt to Extend the British Act to Foreign Countries Should Be Resisted

By Arthur R. Liddell, Charlottenburg

THERE are certain indefensible laws on the statute book which linger on because of the hopelessness of the attempt to get them repealed or even discussed on their merits in parliament. One of these is the enactment relating to deckloads of timber in winter. Unfortunately, some well-meaning people, who are not experts, not only wish to retain this enactment, but actually press its adoption on other nations. The secretary of the Imperial Merchant Service Guild lately took this course, and a contemporary newspaper applauded him, and thought the time opportune for approaching foreign governments in the matter.

Now, naval architects who have given attention to the subject know that the law as it stands interferes in a most unwarrantable manner with business without adding to the safety of either vessel or crew. There is many a vessel in existence that would be the better of a higher deckload than that of 3 ft., and many another that ought not to be allowed to carry any deckload at all.

A vessel intended for the carriage of deckloads of timber is or ought to be specially proportioned for her work. A properly stacked load may be looked on as a partial addition to the height of the vessel. It increases her range of stability, and, provided it be properly secured, it improves the general conditions of safety and comfort in the same way as an additional deck erection would do. The GM-height with deckload is less than it would be in the absence of the latter, but it can also afford to be less, since a vessel with a large proportion of depth to breadth and a high freeboard is in her best sea trim with the least GM-height that is practically possible. Now the least admissible reserve of GM-height is that which might be lost by the burning out of bunker coal and consumption of stores and by the presence of water in the bilges, and this can be determined either by calculation in the drawing-office or by observation made in the course of a voyage or two at sea.

Suitable Seagoing Qualities.

Provided he be not interfered with by the owner, the captain has it in his power to give his vessel the most suitable sea qualities possible on every voyage. He must only know when to cease loading and not give way to the temptation to carry just a little more than he knows to be right.

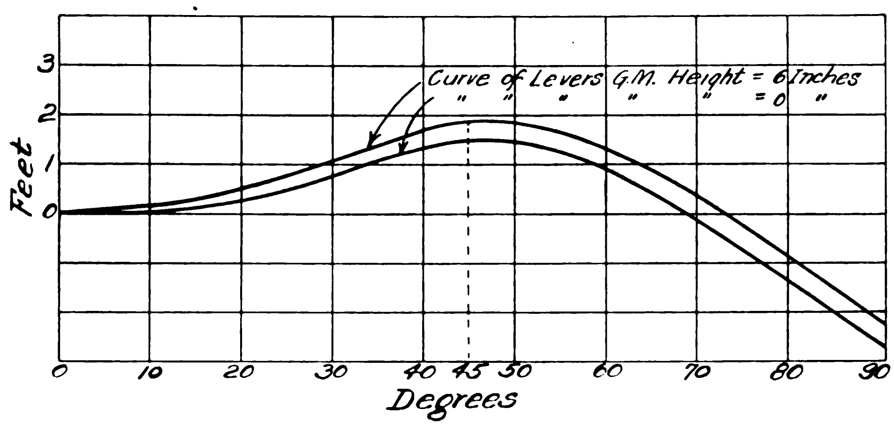
Under the present "police regulation," a vessel that has a large proportion of depth to breadth, and is, perhaps, not fit to carry a deckload at all, may be overloaded with impunity till the "3 ft. above deck" limit is reached, or she takes a decided list; indeed, the non-technical owner will often insist on his privilege. Moreover, the law does not even require that the 3 ft. deckload be distributed in the manner the most suitable for the stability of the vessel. Meanwhile, a vessel which has a small proportion of depth to breadth and a regulation freeboard, and would be an infinitely better sea-boat with an increase of length of erections or their equivalent or with a "heightening" of the erections—quarter-deck—that she already possesses, must not be stacked to a proper height because it "might" be to someone's advantage to overstack her.

From the point of view of stability, the greatest height of deckload that will bring the vessel to her destination without a list should be aimed at, and this may be more or less than 3 ft. The drawbacks to this are the difficulty of securing the cargo from shifting or breaking loose and the danger of the timber deckload becoming heavier by the absorption of moisture or by incrusation by ice. Now, in the countries in which high deckloads are allowed all the year round, means are found for securing the timber to such a degree that few accidents occur—not more, in fact, than with the average run of cargoes—that no one thinks of calling in question. The wetting and iceing-up of the timber are things for which naval architects and seamen have coefficients and rules obtained from experience.

and there is no more difficulty in applying them than there is in making the stowage arrangements of any other vessel.

Curve of Levers.

A timber-laden vessel may, for example, have a temporary proportion of depth to breadth equivalent to about seven-tenths and an unusually large free-board. If we assume a rectangular block 40 ft. in breadth by 28 ft. in depth, with a freeboard of 14 ft.—to top of deckload—and a draught of 14 ft., the surves of levers for GM-heights of 0 in. and 6 in., respectively, may be shown in the illustration.



Curve of Levers

It will be seen that with a GM-height of 6 in. the vessel is almost uncapsizable, and that, assuming the GM-height reduced to 0, the average height of the lever curve is still very considerable and its range a very wide one. It may be objected that the timber stack has spaces between the planks and cannot therefore be regarded as a solid erection. This, however, would mean that the lever curve should be corrected so as to be rather lower at the small and rather higher at the large angles and to have a still wider range, and since the same initial stability would be aimed at in the stacking of the timber, the real conditions would be better than those taken from the block and shown in the illustration. The effect of ice incrustation of the timber is to lower the curve at the small angles and to raise or at least not to lower, it at the large ones.

The fact is, that the police interference ordained by the act is made at the wrong place. If it be desirable to relieve the captain of a vessel of responsibility at all, it is the efficiency of the lashings, and not the height of the deckload, that should be looked after. As the law now stands, a vessel suitable for the carriage of, say, a 10-ft. deckload and not for less than this, is condemned to go to sea in winter with one of not more than 3 ft. in height, which means either that she is undesirably stiff or that she has a small range of stability.

It should, perhaps, be mentioned that a vessel with a well-trimmed deckload of timber will occasionally have the tendency, shown by every vessel with high freeboard, to roll to large angles. When a vessel meets with waves of periods that synchronize with her own, she will roll to greater and greater angles till some change occurs in her resistance to rolling. This is supplied by the dipping of her deck edge into the water. The surface of deck thus immersed acts like a bilge keel intermittently applied, and gradually obtains greater power in damping the rolling motion till the angle of heel is, perhaps, one and a half times that at which the deck edge became immersed. It may, perhaps, be questioned whether the much-prized quality of high freeboard is an unmixed advantage for any vessel. In the case of the timber-laden vessel, however, it is seldom that the side of the deckload forms an unbroken wall, and it is probable that the uncovered deck spaces and the roughness of the exterior will damp the motion before unpleasantly large angles are reached. Besides, with the small initial stability provided, the rolling will develop very slowly, and, indeed, the critical synchronizing waves will be very long ones, such as the vessel will rarely meet with.

Rolling to Large Angles

In general, it may be asserted that, for the carriage of timber, vessels will be in their best and safest trim with the deckloads for which they have been designed, whether in winter or in summer, and a law that restricts and thus practically fixes a particular height for the stack is one that in the majority of cases makes, not for safety, but for danger. In some of the foreign shipping circles that are asked to repeat the British mistake, the responsibility of keeping a timber carrier upright is placed on the shoulders of her captain, and with good results. Since the captain is not always a free agent, it might be still better to extend the responsibility to any others who may interfere with him, whether they can plead ignorance of technical matters or not. After feeling his way for a voyage or two, he will certainly know what is good for his ship and her crew better than any policeman.

If restrictions are to be laid on a timber carrier at all, they should be applied to the design of the vessel herself. She might, perhaps, be forbidden to go to sea with an improper proportion of total depth to breadth, but, the design once passed, the deckload should not be arbitrarily interfered with in the manner now required by law. A deckload of heavy timber will naturally have to be lower than one of light timber, but this would regulate itself. If a regulation must be made, it should take the form that a vessel with a deckload of timber must not either go out of or come into port with a list due to want of initial stability.

New Machine Shop at Cramps

The Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, are adding a new machine shop to their plant. The new building is to be located at Richmond and Dyott streets adjoining the present machine shop, and will be 458 ft. long, 141 ft. 2 in. wide, 60 ft. high, consisting of three bays, the middle bay being 76 ft. 2 in. wide, and the side bays 40 ft. and 25 ft. wide respectively, with an outside storage yard 60 ft. wide. The building will be equipped with one 5-ton, one 10-ton, one 20-ton, three 30-ton, one 50-ton and one 75-ton cranes supplied by the Morgan Engineering Co. The equipment will be of the latest electrically-driven machinery, consisting of boring mills, lathes and other large machines. While the tool equipment has not been fully determined upon, two large boring mills were recently ordered from the Niles-Bement-Pond Co.

The liner now being built at Harland & Wolff's yard, Belfast, for the Holland-Amerika line, will be named Stadtenham. Her dimensions will be 740 ft. long, 86 ft. beam and 48 ft. deep. Her engines are twin-screw reciprocating with a center low pressure turbine.

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Ship Materials Free

The Panama canal act as passed by congress contained a provision admitting free of duty all materials intended for the construction, equipment or repair of vessels in American yards, the exact language being as follows:

> That all materials of foreign production which may be necessary for the construction or repair of vessels building in the United States, and all such materials necessary for the building or repair of their machinery, and all articles necessary for their outfits and equipment, may be imported to the United States free of duty under such regulation as the secretary of the treasury may prescribe.

The secretary of the treasury is now prescribing these regulations and his interpretation of the paragraph will be looked forward to with interest. The point has been raised as to whether under the act a vessel could replenish its outfit, such as crockery, table linens, shapes, etc.

The importation free of duty of material to be used in the construction of vessels in the foreign trade (and in the coastwise trade for six months of the year) has been on the statutes for many years, but no particular advantage was ever taken of it. This restriction as to coastwise trade is now removed and vessels wholly constructed of foreign materials may engage in coastwise service all the year round.

Opinions differ as to the practical outcome of the provisions. As far as shapes and plates are concerned, it is not likely that any will be imported, as there is no material difference in the prices of plates in this country and abroad; but there may be some importation of auxiliaries such as pumps, chains, etc. At any rate, it is important legislation and the effect will be watched with interest.

The Panama Canal

And now it is our friends in Germany who are very much excited over the fact that congress has decided to let our coastwise vessels go through the Panama canal free. They are now declaring that the freedom from tolls granted to United States vessels will seriously injure German shipping. They don't seem to understand that German shipping was never any part of our coastwise trade, and that there is no intention of permitting any foreign ship ever to engage in it. It is purely a domestic problem, always has been, and always will be. American vessels engaged in foreign trade pay tolls the same as any other vessel. The chief advantage of the canal to the United States is the saving that it makes in distance to the west coast of North and South America and to certain points in the Orient.

The Germans have figured the saving in distance from Hamburg to various west coast ports through the Straits of Magellan and the Panama Canal as follows:

To	Magellan Straits	Panama Canal	Difference
Valparaiso	9,062	7,720	1,342
Iquique	9,823	7,112	2,711
Callao	10,303	6,449	3,854
Guyaquil	10,953	5,954	4,999
Panama	11,569	5,112	6,457
Acapulco	12,217	6,549	5,668
San Francisco	13,836	8,414	5,422
Puget Sound	14,550	9,132	5,418

It is estimated that about twelve days would be saved on the voyage from Hamburg to Iquique, twenty-two days to San Francisco and twenty-six to Panama, obviously a very great advantage to German shipping.

As the foreign trade of the United States is almost exclusively carried in foreign ships, they enjoy a great advantage in using the Panama canal when sailing from New York to various far eastern ports. A comparison of these distances via Suez works out very greatly to the advantage of the Panama route, as follows:

	Via Suez	Via Panama	Saving via Panama
Yokohama	13,189	9,709	3,480
Kobe	13,036	9,976	3,060
Nagasaki	12,670	10,259	2,411
Vladivostock	13,248	9,767	3,481
Shanghai	12,406	10,695	1,711
Amoy	11,864	10,966	898
Hong Kong	11,589	11,231	358
Manila	11,446	11,436	10

These economies of distance show the advantage of the canal to foreign vessels visiting our ports. Of course, they are of equal advantage to American vessels trading to those ports, but unfortunately our tonnage under the American flag in the foreign trade is very small, and cannot seriously compete with foreign shipping owing to higher intial cost and higher operating charges.

The present stream of traffic from Europe through the Suez canal to the west coast of the Pacific will undergo no change after the opening of the canal. It will be possible, for example, to reach all the ports in the far east and Australia from Hamburg more quickly by way of the Suez canal than through the Panama

canal. The distances from Hamburg by the two routes are as follows:

Hamburg to—	Via Suez	Via Panama
Singapore	8,395	15,168
Hong Kong	8,032	14,638
Yokohama	11,544	13,163
Melbourne	11,378	13,299
Sydney	11,833	12,036
Auckland	12,958	11,516

As against this the United States gains considerable in distance. Japan, for example, is brought about 3,000 sea miles nearer to New York than it is at present by way of the Suez canal. In fact, all of the ports as far as Hong Kong will be reached sooner by Panama than through Suez. Hitherto the voyage of an ordinary cargo steamer from Hamburg to all parts of East Asia has been from six to seven days shorter than that from New York. The Panama canal will cause this handicap to disappear. The relative distances to the far east from Hamburg via Suez and from New York through Panama are as follows:

To—	From Hamburg via Suez	From New York via Panama
Yokohama	11,614	9,709
Kobe	11,461	9,976
Nagasaki	11,095	10,259
Vladivostock	11,673	9,767
Shanghai	10,831	10,659
Amoy	10,298	10,966
Hong Kong	10,014	11,231
Manila	9,871	11,436

According to this table all ports north of Amoy, especially Japan, will be brought much nearer to New York, but south of that line (and therefore including the Philippines) Hamburg has the advantage. There will also be a similar saving in the distance from New York to Australian ports via the Panama canal as shown below:

To—	From Hamburg via Suez	From New York via Cape	From New York via Panama
Freemantle	9,821	11,508	11,278
Adelaide	10,990	12,128	10,361
Melbourne	11,318	12,206	9,935
Sydney	11,774	12,281	9,584
Newcastle	11,850	12,462	9,754
Brisbane	12,256	12,720	9,806

The Panama canal also brings New Zealand some 2,600 miles nearer New York. The tentative date for the opening of the canal is October, 1913.

Lake Trade

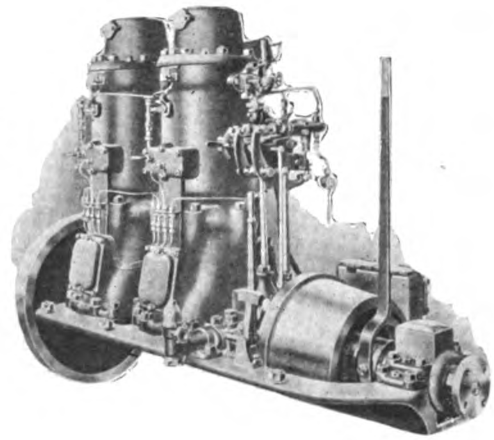
A most curious phenomenon exists today in lake trade and one that is almost beyond belief. There are not ships enough on the lakes to do the business offering. This is a most singular condition when it is considered that even as late as two years ago hundreds of ships were knocking about the harbors unable to get cargoes. Of course, the present condition has been brought about in a fair degree by the elements. Navigation has been attended by numerous elemental difficulties during the past three months, notably a succession of dense fogs which have greatly delayed the fleet in the rivers, but on the other hand it must be borne in mind that the bulk of the trade has depended upon ore. There has at no time during the year been a normal movement of coal and rains in the northwest have greatly interfered with the movement of grain, but notwithstanding these depressing features all the ships have been employed, and in fact some of the older wooden craft that have been lying in ordinary for years have been fitted up and put into commission. Had the coal trade been at all normal, an actual shortage of vessel tonnage would have occurred.

The extreme activity on the lakes is only a reflection of the wonderful revival which has taken place in industrial conditions generally throughout the United States. The iron and steel trade was never more active than it is now. It is unfortunate, of course, that notwithstanding the great transportation movement now being experienced on the lakes, the vessels are making very little money. The freight rate on ore, which, of course, is the dominant trade on the lakes, was reduced to such a point in the early spring that only the largest class of carrier could make a fair profit at the business. In fact, the only vessels that are now making a fair return at the existing rates are those which are controlled by the iron mining and ore consuming companies which can give them ample employment and good dispatch at loading and unloading ports. Of course, when the freight rate was cut no one could at that time see the tremendous impetus that the iron trade was to undergo, but it is an impetus which cannot well be stopped, at least within a twelfth month, and therefore an advance in carrying charges may confidently be expected next season.

It is no more than just that the vessel owner should receive a fair return upon his investment. In fact, he is entitled to a good, round dividend, as his business is at the best precarious. Until lately, very little money has been made in the three great divisions of the iron trade, that is to say, the mining of ore, the transportation of it on the lakes, and the smelting of it into pig iron. When the severe cut in the price of ore was made last spring, many mines were faced with the alternative of doing business at an actual loss or suspending operations altogether. A number of mines that are ordinarily good propositions cannot break even at present prices, and one has only to take the figures of actual costs of materials at the furnaces to realize that until lately none of the merchant pig iron furnaces have been making any money at all during the past three years. The iron business has been conducted altogether on too close a margin of profit, and there can be no real and widespread prosperity in this country until its premier business is placed upon a money-making basis.

Of course, the tendency of prices during the past few months has been upwards and deservedly so, and it is practically a foregone conclusion that the business of 1913 will be transacted upon a higher basis yet. It looks now as though sales of ore for 1913 delivery will be pretty generally concluded before January is over. Merchant furnaces have by no means abundant stocks on hand, and the drain upon the reserve on Lake Erie docks during the winter months will be very heavy.

The Semi-Diesel Heavy Oil Engine

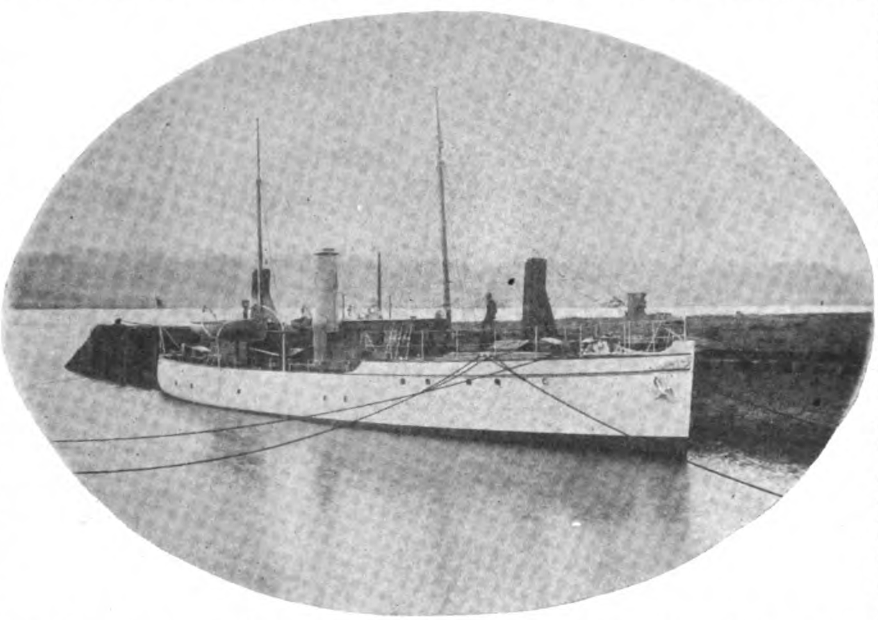


How It Has Been Developed By European Engineers and Put Into Practical Use as Propulsive Power for Yachts and Working Boats. Its Low First Cost Gives it an Advantage Over High Compression Types

By J. Rendell Wilson

THE recent development of the marine Diesel engine has also brought into prominence in Great Britain a class of low-compression heavy oil motor, which, to appease the popular fancy, has now been given the term semi-Diesel. As the editor of *Power Boating* remarked not long ago to me "the name Diesel seems to cover a multitude of sins." Hence a machine which should rightly be termed a low-compression heavy oil engine shall until further notice, according to the unwritten law, be known as the semi-Diesel, and the manufacturer who dares to call a spade a spade is likened unto the unwise that rush where angels fear to tread. For many years this class of engine has been constructed on the continent of Europe, especially in Sweden, where it has been regarded as a heavy-duty commercial motor, and thousands have been installed in fishing craft and barges.

Among the better known types may be mentioned the Bolinders, Skandia, Dux (ex Primus), Swiderski, Avance, Alpha, Kromhout and Dan. Since the demand sprang up, English manufacturers have placed designs on the market including the Beardmore, Nat and Coates, while the above makes all have agencies. The Kromhout is now built in England, as well as in Amsterdam. The sale of this type of engine has been enhanced by reason of the present high cost of gasoline fuel, it being 72 cents and upwards per two-gallon can in the British Isles.



THE MARQUIS OF GRAHAM'S YACHT MAIRI FITTED WITH 130-H. P. BEARDMORE SEMI-DIESEL ENGINE

Now let us turn to the advantages of the semi-Diesel engine. As yet they are all of the two-stroke class, and, as they require none of the intricate and expensive compressors, etc., required by the true Diesel motor, they can be built quite cheaply. No magneto, coil or any electrical ignition whatever is required, so here again is a saving in construction and upkeep. As regards price the single-cylinder 12 B. H. P. Nat engine and reverse gear lists at $375, while the two-cylinder 40 B. H. P. engine with reverse gear costs $1,300, which are lower than the average British marine gasoline equipment. Another advantage is that being slow running a big and efficient propeller can be adopted.

Let me explain briefly how the semi-Diesel engine operates. Over the combustion chamber a small iron box, known as a hot-bulb or hot-pot is mounted on the cylinder head. For starting purposes this is heated by a blow lamp. Between the bulb and the combustion chamber there is a small orifice forming a through connection. On the up-stroke of the piston the atmospheric air is compressed in the combustion chamber, and hot-bulb, to a pressure generally about 200 lbs. per square inch—sometimes less—and just before the top of the stroke, fuel is injected in a spray by a small plunger pump into the hot-bulb and is automatically fired by the heat. Once the engine has got well running the blow lamp can be extinguished as the heat of the explosions maintains the bulb at a red heat provided the engine is not kept running very slowly for too long a period. On the down stroke of the piston air for scavenging is compressed in the crankcase and admitted or by-passed to the cylinder through ports in the usual manner. It will be seen that the difference from the Diesel lies in the fact that ignition or combustion, is not by heat generated by high compression, the latter needing very delicate machining, as well as accessories such as fuel injection, air blast fittings, including special valves, compressors, and reservoir tanks.

Has no Equal for Economy

In sizes ranging from six to 150 B. H. P. the semi-Diesel has no equal for economy in running, as either gasoline, kerosene, or cheap residue oils can be used, and its first cost is not high, also its size and weight are far from excessive. In the

British Isles large numbers are in use in lighters, coasting vessels, fishing-boats, barges, and ferry-boats, while a few have been installed in cabin-cruisers and yachts; but of the latter class large numbers will have this type of engines fitted during the coming winter. As soon as American marine engineers and cruiser owners realize the advantages of the semi-Diesel engine, and the safety gained by its adoption, there is no doubt that there will be a big demand. The manufacturer who first recognizes this and pushes it in a practical manner will reap his reward. Already the Viper Co., of Nova Scotia, has taken up this type of motor—the Nat, I understand,—and hopes to do great things with it in their district.

Power Plant of Papakura, a Scottish Yacht

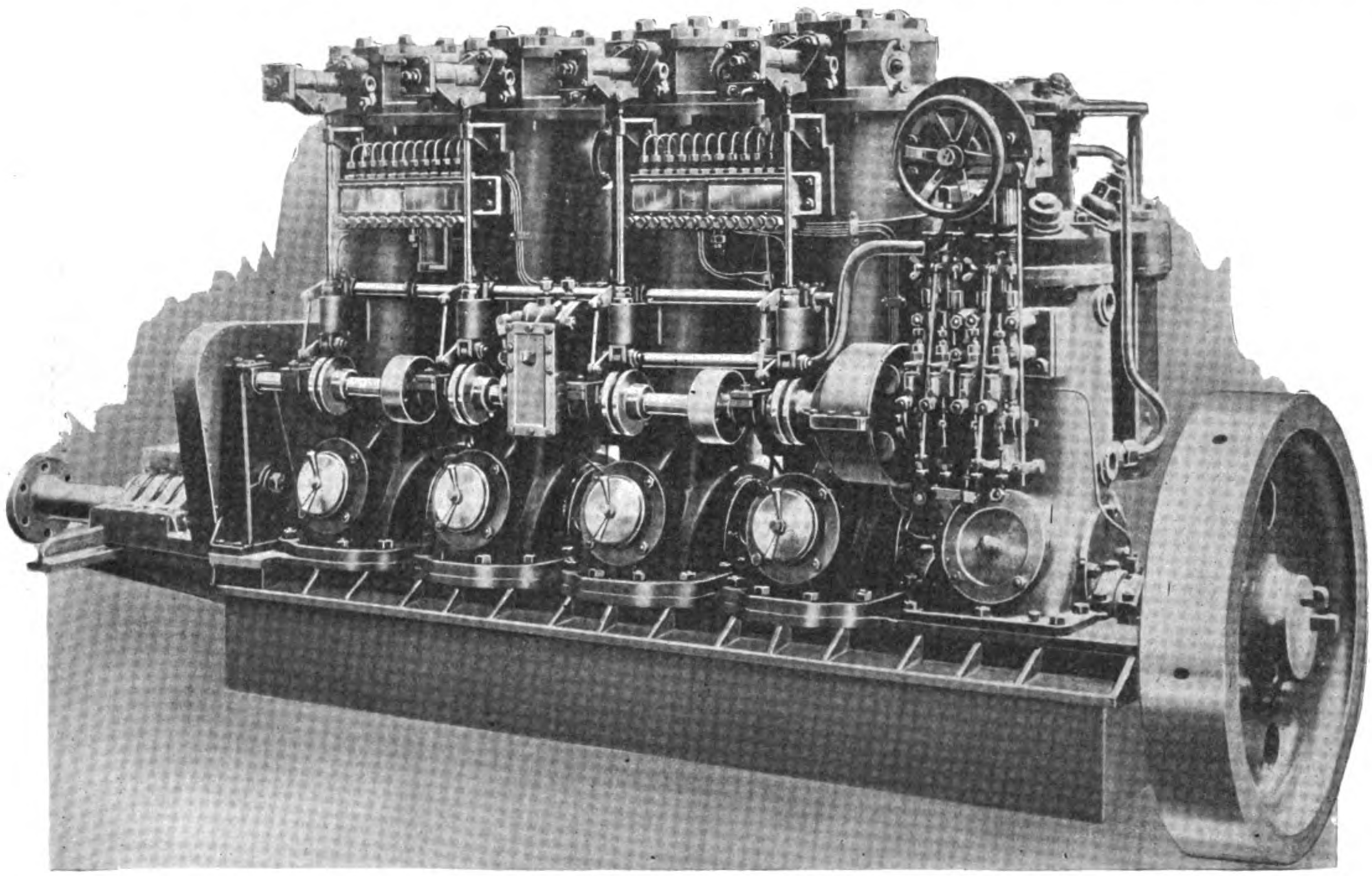
Among the Swedish engines the Bolinders is noteworthy. It is manufactured by the Bolinders Co., of Stockholm, and amongst the pleasure craft recently fitted with one of these motors is Walter Brock, a Scottish powerboat man's new motor yacht Papakura, built for him by McLaren Bros., of Dumbarton, N. B., for service on Clyde waters. She is 60 ft. long by 11 ft. 6 in. beam, with 6 ft. molded depth and is of steel and wood composite construction. Her frames, beams and reverse frames are of 1¾ in. by 1¾ in. by 3/16 in. galvanized steel, while her planking is of 1½ in. teak, and her deck of 1½ in. yellow pine.

But it is in the engine room that our interest is centered. The installation was carried out by Messrs. Douglas, Primrose & Co., of Glasgow. The propulsive machinery consists of a two-stroke type direct reversible four-cylinder Bolinders heavy oil engine of 80 B. H. P. The cylinder bore is 9 7/16 in. by 9 27/32 in. stroke, and the power is developed at 425 revolutions per minute. The weight of this engine complete with stern gear is four tons and the guaranteed maximum fuel consumption is 6.4 gallons per hour at full speed. Air pressure for starting is obtained from a reservoir which is connected to the cylinders, and is charged up from the explosive pressure in the cylinders while the engine is running.

Constructional Details of Papakura's Engine

The constructional details of the engine are of special interest, as the arrangements are very complete. The cylinders with their fuel pumps are controlled in pairs, and so I will describe the mechanism of the after pair, the mechanism of the forward two being exactly the same. Mounted on the after cylinder are two crescent-shaped arms, or rockers, for operating the plunger-type fuel pumps. These rocker-arms are actuated by eccentrics on an extension of the crankshaft. The upper end of each rocker-arm works a striker, which is mounted on a swinging fulcrum and slides on a stepped surface. Each striker, as it moves backwards and forwards, works its fuel pump and just before a piston reaches the top of the stroke a charge is injected, the cylinder air-pressure then being about 110 lbs. per sq. in.

To vary the amount of fuel injected, and consequently the speed of the engine, the positions of the rocker-arms are altered by means of a small hand lever, thus shortening the stroke of the pumps. The latter are very small, being about ⅜ in. bore by ⅛ in. stroke, varying, of course, according to the size of the engine. Governing is automatic and quite simple. Should the engine speed be excessive, each striker jumps on the stepped surface on which it slides, causing its striking blade to miss the striking blade of its fuel pump. Consequently no fuel can be injected until the engine is again



FOUR-CYLINDER, 130-H. P. BEARDMORE HEAVY OIL ENGINE INSTALLED ON MOTOR YACHT MAIRI

turning at normal revolutions. The combustion chambers are, by the way, fed with a continuous water drip, which gives extra power and aids to cool the engine.

Reversing the Bolinders Engine

Reversing of the engine is direct, but a clutch is necessary. The lower end of each rocker-arm operates an auxiliary fuel-pump, which only comes into action when it is required to reverse the engine. On the engine-shaft there is a loose sleeve to which is connected one end of a rod, the other end being secured to the rocker-arms. On jambing the sleeve, by means of a lever, against the engine-shaft, the friction slightly lifts the rod and, of course, the rocker-arms, thus throwing the main fuel pumps out of action and bringing the auxiliary pumps into operation. As no fuel is being injected the engine slows down. The reason that no fuel is being injected is because the speed of the engine causes the governing apparatus of the auxiliary pumps to be in force. However, as soon as the engine slows down, a charge of fuel from one of the auxiliary pumps is injected on the up-stroke of the piston, causing a back-fire and sending the piston back again, incidentally the crankshaft continues turning in the reversed direction, as the main fuel pumps instantly resume their duties. Reversing occupies under 10 seconds.

The cranks are set in pairs, numbers one and three being together, and at 80 degrees to numbers two and four, the cylinders whose cranks are together firing simultaneously. Among other Bolinders-engined motor yachts may be mentioned Bamba VI, owned by Dr. McMahon, of Cork, and the Scottish cabin cruiser Etive. The Bolinders engine was introduced into England by Messrs. J. Pollock, Sons & Co., of London.

In the Nat engine we have one of the very few British-built and designed machines of this type. It is constructed by the Torbinia Engineering Co., of London, and it is this engine the Viper Co. has taken up. A two-cylinder 16-H. P. plant is installed in the cabin cruiser Alert. As the engine has not been on the market two years, not many yachts have been fitted by the makers, but a number of business boats have.

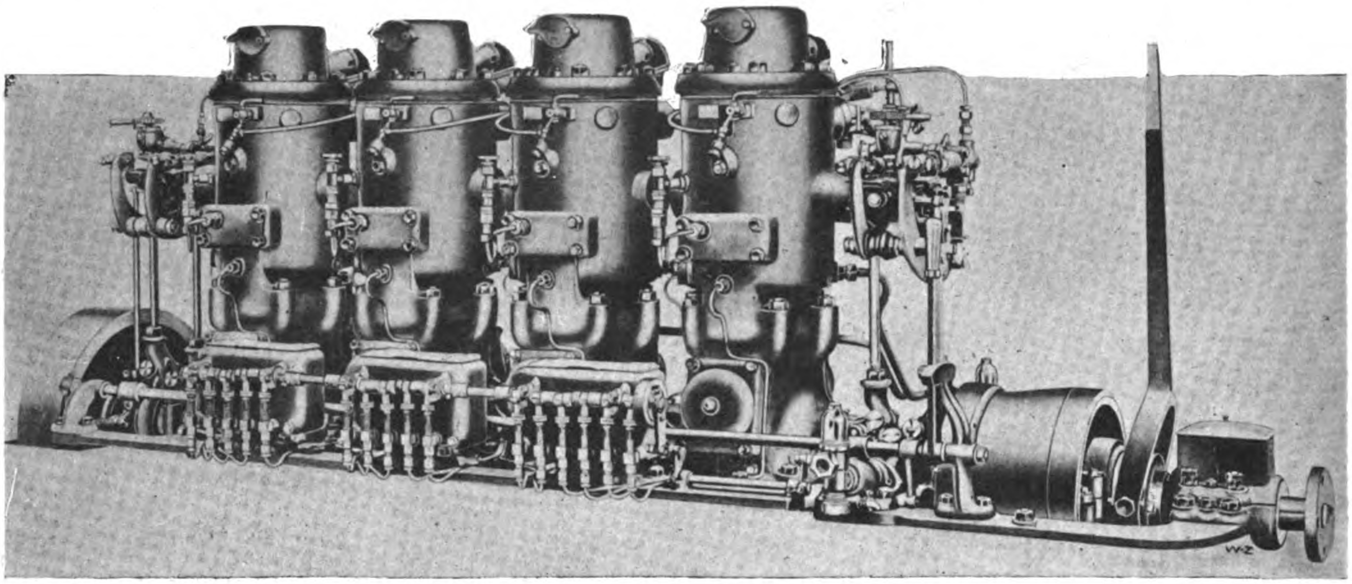
It differs in several ways from the Bolinders; and the principal features are that all the fuel pumps are operated by one rocking-lever mounted on the after cylinder, and the control is pneumatic, the speed of the engine being regulated by a small wheel valve. There are no ordinary valves, cams, gears, half-time shafts, water spray, or carburetor. Fuel having a specific gravity as high as 0.950 may be used, but the manufacturers recommend the use of Texas or Russian fuel oil, and gas oil (gasoleum). The engine of Alert has two cylinders 6½ in. bore by 6½ in. stroke, and develops its rated power at about 400 R. P. M., but working can be maintained at 160 R. P. M. It is of the three-port, two-cycle class with hot-bulb ignition, while the fuel consumption is about 0.7 pint per B. H. P. per hour. Cylinder compression is between 150 and 200 lbs. per sq. in.

The Small Power Nat Engine

The main rocking-lever is driven off one end by a vertical shaft from an eccentric on the engine shaft, the other end of the rocking-lever working the plunger-type water circulation pump. A bell-crank extension on the upper part of the rocking lever actuates the fuel pump by means of strikers on the hit and miss principle. Connected to the striker of each fuel pump is a small vertical rod, on the lower end of which is a piston with about ⅜ in. stroke, by 2 in. bore, working in a little dash-pot (air compressor). The up and down movement of this rod causes the striker to miss or hit the plunger of the fuel pump as desired. How this is done is best described as follows:

Action of the Nat Engine

The down stroke of the piston takes place under the action of a spring, the only outlet for the compressed air being at the bottom of the dashpot through a small wheel valve, and the latter can be carried to rear by the helmsman's hand by means of a pipe, or flexible tubing. Thus the down stroke of the piston, and the angular swing of the striker, are controlled by the wheel valve. By setting the latter for a certain engine speed, the duration of the exhaust period, and consequently the rate of travel of the small rod, coincides with the movement of the rocking-arm and the fuel pump is actuated by the striker. But should there be an increase in the engine speed, the synchronism between the two motions is upset, causing the striker to be temporarily deflected from its proper position, and it fails to operate the fuel pump, until the running speed is sufficiently reduced. From a description this would seem somewhat complicated, but in



80 H. P. BOLINDERS SEMI-DIESEL ENGINE ON THE POWER YACHT PAPAKURA

reality the mechanism is very simple. The ease of control, merely by turning a wheel valve, is quite apparent.

The Beardmore—a True Semi-Diesel Type

Another British-built and designed low compression heavy-oil engine is the Beardmore; but in this case refinement of detail has been carried to a greater extent than has the Nat, the fuel being injected by air blast, consequently it is a more expensive machine. The term semi-Diesel applies better, perhaps, to the Beardmore than to any other make. The makers are Messrs. Beardmore Bros., of Dalmuir, and the marine oil engine department is but a small section of this great firm of naval constructors. Apart from commercial craft, probably the most notable vessel with a Beardmore oil engine, is the Marquis of Graham's 65-ton raised-deck motor-yacht Mairi. This boat was completed towards the end of last year, having been built of steel to Lloyds 100 A-1 yacht class by Ritchie, Graham & Mylne. She is 85 ft. 3 in. long over all by 78 ft. low water line. with 13 ft. 6 in. beam, 8 ft. molded depth and 6 ft. draught. For auxiliary sail purposes, she is rigged as a two-masted schooner, and there is rather a tall funnel just abaft amidships, over the engine room, to which the exhaust outlet is carried.

Beardmore Engine in Mairi

Her Beardmore engine is of the two-cycle direct reversible type with four cylinders 9 in. bore by 12 in. stroke, and 130 B. H. P. is developed at 350 R. P. M., giving Mairi a speed of over 10 knots—11 knots was attained on trials. At the forward end of the engine is a two-stage air compressor and an inter-cooler, which are driven by an extra crank. The compressor is used for charging storage bottles for fuel-injection, starting, reversing, and the siren. The cranks of the engine cylinders are 90 degrees to each other, the compressor crank being set to compensate the unbalanced force. Crank-case compression is employed. the sub-divisions carrying the main bearings, and the air-scavenging and exhaust ports are uncovered by the pistons in the usual manner. The fuel generally used has a specific gravity of 0.9 to 0.93, and a blow lamp is necessary for starting. Fuel is injected against a hot baffle in the hot-bulbs at 400 lbs. per sq. in. To each cylinder there is a separate fuel pump, but the pumps are coupled and driven in pairs.

Starting, stopping and reversing are done by a single control wheel, and the three operations can be carried out in about four seconds. The wheel in question controls a rotary air distributing valve and also automatically adjusts the fuel injection valves. The distribution valve consists of a rotating disc with a single port in it, which registers, in turn, with four small ports connected by piping to the cylinders. Lubrication is by force feed from a battery of sight-feed pumps, a connection being carried to each working part. The water circulating and bilge pumps are driven off the after end of the engine, as is also a little auxiliary air compressor. The engine room auxiliary machinery consists of a 7 H. P. Reavell gasoline engine, which drives a stand-by two-stage air compressor, a powerful centrifugal pump, and a dynamo for lighting the ship throughout. Sufficient fuel for a voyage of 700 sea-miles at full speed, is carried in two tanks arranged at the fore end of the engine room.

Now that the construction of the true Diesel engine has been taken up in America, there seems to be no lack of orders, in fact I understand that manufacturers like the New London Ship & Engine Co. of Groton, Conn., have difficulty in keeping apace with orders. Now the semi-Diesel type is much easier to construct, and in the United States its price should be within reach of all. By reason of the heavy oils that can be used, danger from fire, where large quantities of fuel oil are carried is greatly reduced.

At the present time gasoline power for a pleasure yacht or work boat is limited to about 600 B. H. P.; but there is no obvious reason why such a vessel should not be fitted with, say, three 350-H. P. semi-Diesel engines. In fact, a 350-B. H. P. Bolinders is now being installed in a Scottish auxiliary ship. The saving in fuel costs over steam or gasoline machinery must be enormous with such a vessel, residue oil being so cheap in America. Personally, the writer considers that this class of engine must eventually be adopted quite generally by American marine engineers.

Emergency Lighting Sets

The lessons of the Titanic disaster are being quickly turned to good account, and one outcome is the equipment of ships with auxiliary engines for electric generating purposes.

Very satisfactory reports have been made of the Mirrless-Diesel emergency sets which have been installed on the White Star liner Megantic. The engine is a 45 B. H. P. Mirrless-Diesel oil engine, direct coupled to an electric generator. It works at 450 revolutions per minute, and is of the enclosed type with forced lubrication. The combined set is fixed on the upper deck, and a separate circuit is taken round the ship from the dynamos. This circuit provides sufficient lights in the passages, companionways, and near the lifeboats, to enable passengers to move about freely and the boats to be launched, even though the steam-driven dynamos in the main engine room are put out of action. The circuit is also connected to the wireless apparatus. In the event of an accident to the vessel, sufficient lights and the wireless telegraph apparatus could be kept going until the hull is completely submerged. The importance of this, as an aid to the launching of the boats without confusion or panic, and as a means of calling for help up to practically the moment of sinking, will be readily seen.

The installation of such a self-contained unit, carrying its fuel supply in close proximity to the engine, is to be preferred to a steam-driven dynamo, even if the latter were placed in the same position on the vessel, as to avoid the storage of coal and consequent dust on the upper deck, the steam for the engine would probably be drawn from the boilers in the main boiler room, which, owing to their situation below the water line, are liable, in the event of an accident, to be put out of action by the flooding or other damage to the boiler room. The "Mirrless-Diesel" works on crude or residual petroleum, the flash point of which is 230 degrees Fahr., consequently, there is no risk of fire, as would be the case if paraffine or petrol engines were installed for this purpose. The board of trade, furthermore, prohibits the carrying of paraffine or petrol. The installation of such a plant would remove the necessity for any engineer or fireman remaining below after the propelling machinery is shut down.

On board the Megantic the engine is set to work as darkness approaches, and is run until daylight, thus insuring the continuance of sufficient lights and the Marconi apparatus in the event of an accident to the vessel or steam plant. The engine is also run continuously during foggy weather.

These engines have been supplied to the British admiralty, the commonwealth of Australia, and the Japanese government, and are manufactured by Mirrless, Bickerton & Day, Ltd., of Stockport, Eng., who have at present in hand a large number of orders for emergency electric generating sets for ships now building.

Electrically-Driven Ship

The Montreal Transportation Co. is Building Abroad a Vessel for the St. Lawrence River to be Equipped With Diesel Engines and Electric Drive

THE Montreal Transportation Co., Montreal, has purchased from Swan, Hunter & Wigham Richardson, Newcastle-on-Tyne, a vessel of Canadian canal size, which is to be equipped with Diesel engines and electric drive. She will be the first merchant ship to be so driven. The vessel is of the following dimensions:

Length over all, 256 ft.
Length between perpendiculars, 250 ft.
Extreme breadth, 42 ft. 6 in.
Depth molded, 19 ft.
Forecastle, 48 ft.
Poop, 42 ft.
Speed, 9 knots.

It is estimated that the vessel will carry 250 tons more than a similar vessel with ordinary reciprocating engines. She is designed to carry 2,400 tons deadweight of cargo, fuel, fresh water and stores, on 14 ft. mean draught in fresh water.

Two steam boilers are provided for working the deck equipment, steering gear and electric light, and for the supply of heat for the living quarters. It may at first seem out of place to return to steam equipment for these uses, but the conditions of the service in question are such as to call for an auxiliary equipment at small capital cost. The season is short and the amount of work called for from the auxiliary equipment is small, and therefore although an electric equipment would be much more economic in working, there is no opportunity for the more economic plant to justify the increased capital expenditure, which is very considerable. The necessity for providing steam for heat has also a strong bearing upon the case. If the steam boiler has to be used it involves but little additional expense to provide steam for the steering gear, electric light and whistle. The boilers are oil-fired and the fuel and working pressure are in perfect control. The same fuel is used in the boilers as in the internal combustion engines. The main machinery equipment is, as shown in the drawings, in two units, each consisting of an engine, dynamo, and a winding on the propeller motor.

Description of Engine

The engine works on the Diesel four-cycle principle and has the following main dimensions: Cylinders, 12 in. diameter; stroke, 13½ in.; r. p. m., 400. There are six cylinders and the cranks are so arranged that the firing takes place at equal intervals.

The working parts of the engine are entirely inclosed and a system of forced lubrication is used, supplied by a valveless pump driven by an eccentric on the crank shaft placed at the compressor end. The second motion shaft is driven by means of a worm wheel mounted on the crank shaft directly midway between the center cylinder through a vertical shaft, which also carries the governor at its upper end. On the second motion shaft, which is placed at the front of the engine and carries the cams for operating the valves, are mounted the eccentrics which drive the two fuel pumps, there being a separate pump for each cylinder. This arrangement enables the power to be very equally divided between the cylinders. The compressor is driven directly from the main crank shaft and is mounted in the bed plate which is extended to carry it.

Electric Equipment

The starting of the engine is effected in the usual Diesel manner, by means of compressed air stored in receivers placed in a handy position near the engine. The compressed air for this purpose is supplied by the compressor on the engine, which also supplies that required for blowing the fuel oil into the cylinders. The engine is provided with a patent device for preventing the accumulation of fuel oil in the fuel valves, which are inoperative during starting. A small flywheel is fitted of sufficient weight to insure steady running and to facilitate barring round when required. It is bolted to a flanged coupling forged solid with the crankshaft.

Cooling water is circulated through the cylinder and compressor jackets by a pump of the rotary type which draws directly from the sea. This pump is driven by miter gearing from the compressor end of the crankshaft. The exhaust pipes are water-cooled.

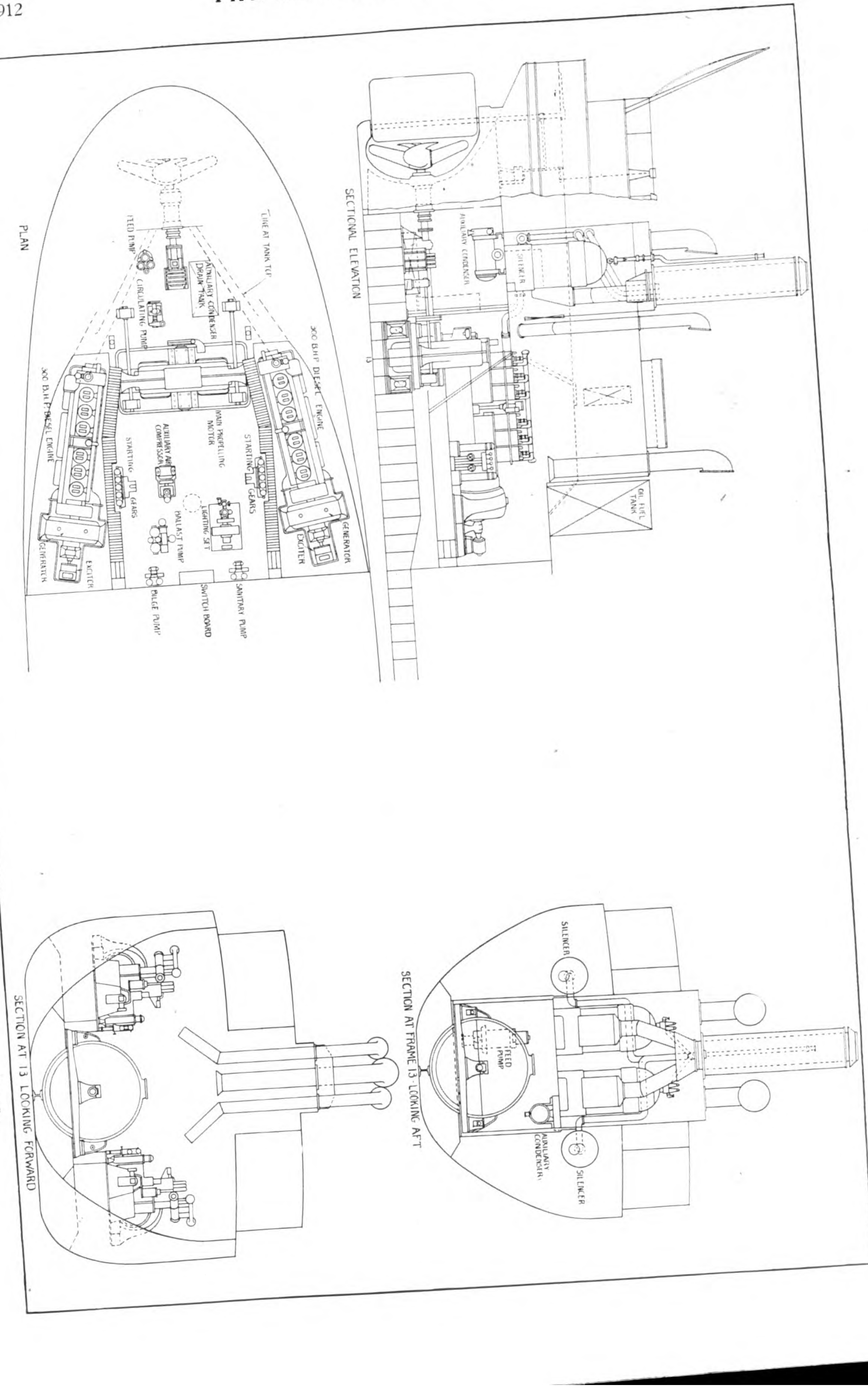
The air for the main cylinders is drawn through the bed plate, thus effectually silencing the suction.

In the normal operation of the ship the engines run under governor control at 400 r. p. m., but the speed of revolution can be adjusted by manipulating the governor so the engine may maintain constant revolution per minute at a rate considerably below 400, should this be required.

The electric equipment consists of two three-phase generators, each giving about 235 kilovolt-amperes at 500 volts alternating. The generators have six and eight poles, respectively, giving frequencies of 20 and 26.6 per second. Connected to the shaft of each generator is an excitor which in normal working gives about 30 amperes at 100 volts, but is capable of a considerable overload. A single three-phase motor is coupled direct to the propeller shaft. This motor develops 500 shaft h. p. The rotor is of the simple squirrel cage type without any electrical or mechanical connections other than its rigid attachment to the propeller shaft. The stationary part of the motor has two separate windings for 30 and 40 poles, respectively. The windings are mutually non-inductive, so that except for slight leakage of magnetism, they exercise no influence whatever on one another and operate independently on the magnetic circuit of the motor. When these two windings are connected respectively to the appropriate generator, the synchronous speed due to each is 80 r. p. m. when at full speed, or actually about 78 r. p. m. when at full speed. By changing the connections the direction of rotation is reversed and by connecting the 40-pole winding of the motor to the 6-pole generator, the synchronous speed drops to 60 r. p. m., or actually to 58 r. p. m., giving about three-fourths of the full speed of the ship under this condition. One generator may be stopped and the other left running at full revolutions under governor control, and therefore at approximately its full economy, because the power required to drive the ship at three-quarter speed is about half of that required to drive it at full speed. If either of the generators is left attached to its own winding, the other generator being shut down either by intent or by accident, the ship is propelled by either engine at a little over half speed, the speed of the ship falling with the speed of rotation of the engine until an automatic adjustment of power and speed is reached. This occurs at about half speed.

Control Gear

The control gear is so simple as to hardly require any specific description. In the first instance, it is not proposed to operate the control from the bridge, but arrangements are made by which this can easily be done, if required. There are five positions on the switch



ARRANGEMENT OF MACHINERY OF THE DIESEL-ENGINED SHIP WITH ELECTRIC DRIVE FOR THE MONTREAL TRANSPORTATION CO.

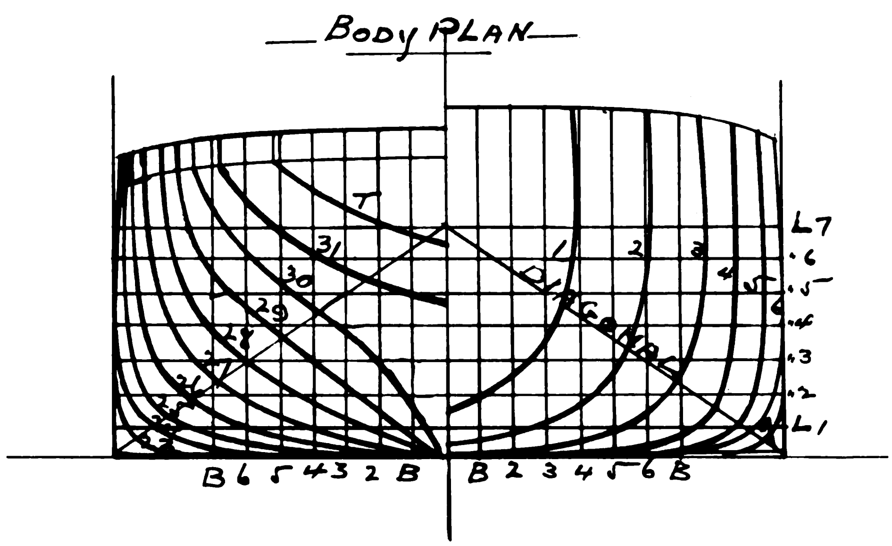
corresponding to the ordinary positions on the engine room telegraph. They are "full speed ahead", "half speed ahead", "stop", "half speed astern" and "full speed astern". Each position of the controller is definitely fixed by means of cams and roller so that stopping at intermediate positions is prevented. For half speed, No. 1 generator is coupled to No. 2 winding of the motor, and No. 2 generator is running light or stopped. For full speed each generator is connected to its own winding in the motor respectively. The controlling gear provides for the interruption of the excitation of the generators while the switch is being moved from one step to another. This mode of operation renders the electric circuits dead while the switching-over operation is being accomplished, and thus injurious sparking is avoided.

Isherwood System of Construction

In Which the Sheer, Half Breadth and Body Plans Are Discussed—When the Ship is Considered Fair

By Robert Curr

ROBERT CURR began in the September issue a series of articles descriptive of an Isherwood type steamer, 203 ft. long, 40 ft. beam and 18 ft. deep. It is Mr. Curr's intention to discuss every problem involved in the construction of the ship. Not a section will be overlooked and reasons will be given for the location of everything in the ship. These series should prove very helpful to students, draftsmen and ship designers generally.



PLAN 2—THE SKELETON OF THE SHIP

LINES.

PLAN 2. Shows the lines of this vessel which might be termed the skeleton of the ship.

The lines require three plans for reference: The SHEER, HALF BREADTH and BODY PLANS.

SHEER PLAN LINES: Base, sheer line at center, sheer line at side, knuckle line, level lines, stations, bow and buttock lines, diagonal line and endings.

HALF BREADTH PLAN LINES: Base, buttock and bow lines, deck line and diagonal.

BODY PLAN LINES: Base, rise of floor, level lines, molded width, diagonal and stations.

SHEER PLAN: This longitudinal elevation of the portside of the vessel with stem and stern post removed can be proceeded with as soon as the dimensions of the vessel are determined.

The keel forms the base, and lines run in parellel to same, are the level lines, and spaced 24 in. apart.

STATIONS: Are perpendicular and spaced 3.366 ft. apart. These stations are numbered from 1 to 31.

The stem shape is a matter of taste. Some prefer the straight stem; others the flare or inclined aft.

The run under the stern is governed by the diameter of the propeller; it being necessary to leave a clearance of a few inches between the shoe and the hull.

The height of the deck at the extreme after end is 20 ft. and the fore end 21 ft. 6 in. The lowest point extending from stations 18 to 21 is 19 ft. 1 in. at the center. The sheer aft would in this case be 11 in., and forward 2 ft. 5 in. The sheer diagrams will be explained later on.

In order to secure the sheer at side reference must be made to the beam camber. This vessel's deck is crowned 10 in., and as long as the side remains parallel the sheer line at the side will be 10 in. below the line at center. The narrowing up of the deck changes the side line until it rises to the line at center, at bow and stern.

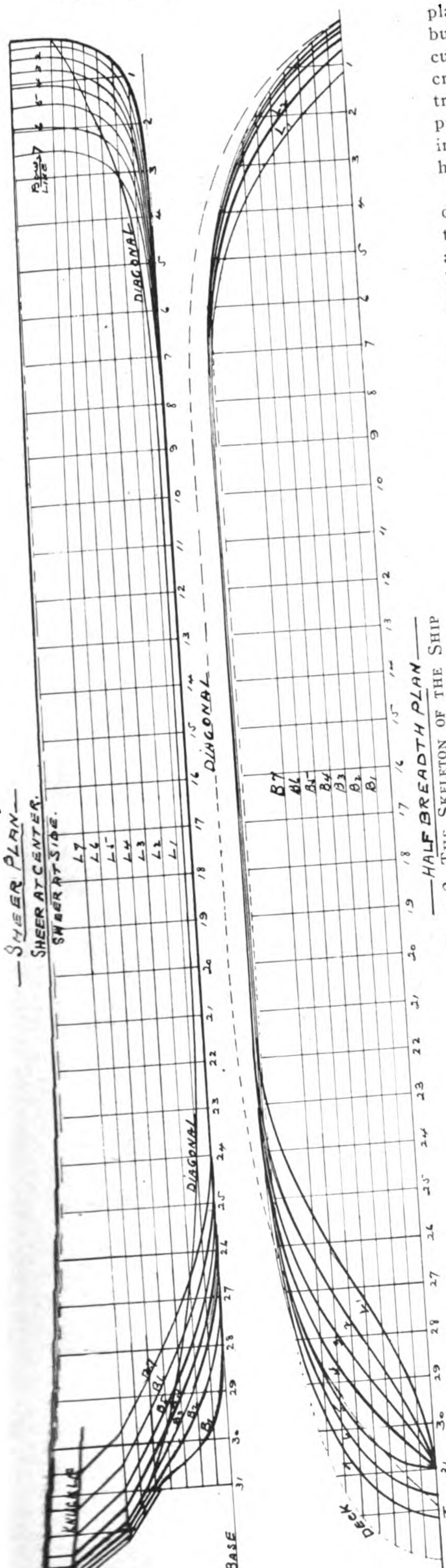
The width of the deck line must be run in on the half-breadth plan, and transferred to the beam camber. The difference between the top of the crown and the point of width secured from the deck gives the drop of sheer at side. The knuckle line is 18 in. below the deck line and run in parallel to the sheer at side.

Bow and buttock lines can only be secured after the stations have been faired in the body plan and level lines in the half breadth.

HALF BREADTH PLAN: A line parallel to the base of the sheer plan is run in at a suitable distance from the sheer plan, so that the lines of this plan will not cross the lines of the sheer plan.

The base line on the half breadth plan represents the center line of the ship. The stations are transferred from the sheer plan and the deck line run in as shown by dotted line. This deck line is a fixture and when the height ,of same is transferred, by means of the beam curve on to the sheer plan, it makes the height and width of deck fixtures.

Parallel lines are run in on this



PLAN 2—THE SKELETON OF THE SHIP

plan, which are termed bow and buttock lines. Level lines are shown curved on this plan, and where they cross the stations the points are transferred to the body plan. This process is repeated until the sections in the body plan and level lines in half breadth plans are fair.

BODY PLAN: A base line is drawn in and level lines run parallel to same; the base and level lines are the same as the sheer plan, the lines being extended to the body plan from the sheer.

Bow and buttock lines are run in parallel to the center line and spaced 24 in. apart. The stations are curved in this plan and are shown in their true form. Where the sections cross the level lines the points are transferred to the half-breadth plan and when made true shows the level line in its true form.

The sheer heights in the body plan are transferred from the sheer plan by simply measuring the depth from the base line on the sheer plan. The bow and buttock lines are transferred from the body plan to the sheer plan by measuring up on the buttock line to where the sections intersect same and when faired up in the sheer plan shows the bow and buttock lines in their true form. Another test for proving these lines is to raise perpendiculars from the half breadth plan and if they pass through the same intersections in the sheer plan there is little doubt of the fairness of the buttocks.

DIAGONAL LINES: This line is another test of fairness and a very useful one. The line is run straight in the body plan and transferred to the sheer and half-breadth plans. In the half-breadth plan this line extends beyond the other lines, as shown dotted in. On the sheer plan it cannot be mistaken for anything else.

When, after the points of two plans have been transferred to the third and show continuous curves without abruptness, the ship is considered fair.

Plight of a Tug

Editor MARINE REVIEW:—Noticing in the September number of your magazine the account of the remarkable stranding of the steamer City of Seattle, on the Pacific coast, I was reminded of a nearly parallel case which I witnessed. I happened to have the enclosed cut showing the incident, and you are welcome to it if you consider it of interest.

The tug is the M. Mitchell Davis, 85 tons gross, of Portsmouth, N. H., and she went ashore on Hicks Rock, in Portsmouth harbor, during a thick fog, on July 30, 1908. Unlike the City of Seattle, whose engines were stopped, the Davis was under one bell when she struck. In spite of this, she was absolutely undamaged and was not even drydocked, though she went on at extreme high water and laid

TUG M. MITCHELL DAVIS ON THE ROCKS

for one whole tide across a ridge of sharp rocks. Only the timber braced under her guards, which show in the picture, prevented her rolling off into eight fathoms of water.

D. A. WASSON.

Colorado Springs, Colo., Sept. 25, 1912.

Obituary

John Haug, consulting engineer and naval architect, died at his home in San Francisco, on Sept. 9. Mr. Haug was a native of Germany, and acquired his first experience in engineering work there. He later went to England and was associated with the late J. Macfarlane Gray, afterwards coming to the United States and entering into partnership with Mr. Archbold, who had been chief engineer to Commodore Perry's expedition to Japan in 1852. Mr. Haug was ship and engine surveyor to Lloyds, at Philadelphia, from 1880 to 1900, when he resigned to devote his time to consulting work. He designed ships and machinery and superintended construction for the Philadelphia & Reading Railway Co., the Red D line, the New York & Porto Rico Steamship Co., and the Chesapeake Steamship Co., and the Standard Oil Co. He was a pioneer in the introduction of bulk oil vessels and was greatly interested in the application of internal combustion engines to their propulsion.

Erie Railroad Transit Line Improvements

That the present management of the Erie railroad is rapidly advancing that property to the first rank position is well known and its progressive policy with regard to its floating equipment, has already been noticed.

The most recent step in this direction was the placing of contracts by the company's consulting engineers, Babcock & Penton, a few days since for a thorough remodeling of the machinery equipment of the steamers F. D. Underwood and Delos W. Cooke, formerly the Ramapo and Starrucca.

In several respects this decision is remarkable, if not radical. The alteration of ships of older types in order to improve their efficiency is not uncommon and the results are generally gratifying, but the practical discarding of a strictly modern plant is decidedly unusual. These ships are the newest of the fleet and their existing equipment is certainly not inferior to that of scores of others which are looked upon as fully up to date regardless of size. Careful tests, extending over the whole season, of the performance of other ships of the fleet which have undergone alteration have shown that a new mark has been set in economy of operation and have led to the decision to go still further. The outcome will be watched with interest. Figures supplied by the management, while incomplete for the year, show that the overall reduction in fuel cost per ton mile since 1910 is about 34 per cent, even with a speed increase of over 7 per cent.

In this connection it is of interest to note that another large fleet of strictly modern ships has been placed in the hands of the engineers above referred to for investigation and recommendations.

The contracts for the work on the Underwood and Cooke have been placed with the Lake Erie Engineering & Boiler Works, Buffalo, and in addition thereto a considerable amount of work will also be done by the line's own organization.

Lake Ship Building

The bulk freighter, James A. Farrell, named in honor of the president of the United States Steel Corporation and building for the Pittsburgh Steamship Co., was launched from the Lorain yard of the American Ship Building Co., on Saturday, Sept. 28, being christened by Miss Theresa Farrell. The Farrell is one of the three steamers building on the Isherwood system for the Pittsburgh Steamship Co., and is 600 ft. over all, 580 ft. keel, 58 ft. beam and 32 ft. deep, having triple-expansion engines, 24, 39 and 65 in. cylinder diameters by 42-in. stroke, supplied with steam from two Scotch boilers, 16 ft. by 11½ ft.

The town of Lorain honored the event by practically converting the day into a holiday, and the ship building company certainly did its part, serving luncheon to 300 guests in the mold loft immediately after the launching. James H. Hoyt acted as toastmaster. The address of Mr. Farrell showed a surprising familiarity with lake conditions and the coincident development of unloading appliances and modern bulk carrier. He spoke of the various products of the steel plant at Lorain and said that notwithstanding the fact that some of the employes accept employment elsewhere because of opportunity to work seven days continuously per week, the Corporation saw no reason to alter its belief that six days continuous work was sufficient and best for all interests. He also predicted prosperity for at least 12 months, no matter what happens meanwhile.

Addresses were also made by H. Coulby, president of the Pittsburgh Steamship Co.; J. C. Wallace, president of the American Ship Building Co., Col. H. P. Bope, vice president of the Carnegie Steel Co.; E. J. Buffington, president Illinois Steel Co.; Wm. B. Schiller, president National Tube Co.; Wm. P. Palmer, president of the American Steel & Wire Co.; Hermon A. Kelley, general counsel for the Pittsburgh Steamship Co.; Wm. A. Little, president of the Board of Commerce of Lorain, and Wm. E. Hughes, city solicitor of Lorain.

An interesting feature was the fact that the presidents of all the subsidiary companies of the Corporation were present, with the exception of Mr. Dinkey, of the Carnegie Steel Co. The list included, in addition to the ones mentioned above, J. A. Hatfield, president of the American Bridge Co. of New York; Daniel Coolidge, president of the Lorain Steel Co.; E. W. Pargny, president of the American Sheet & Tin Plate Co.; Edward M. Hagar, president of the Universal Portland Cement Co.; A. F. Banks, president of the Elgin, Joliet & Eastern railroad; W. A. McGonagle, president of the Duluth, Missabe & Northern railway; W. J. Olcott, president of the Oliver Iron Mining Co.; F. E. House, president of the Duluth & Iron Range Railroad Co., and August Ziesing, president of the American Bridge Co.

On Saturday evening, Mr. and Mrs. Coulby gave a reception and dinner at the Country Club in honor of Mr. and Mrs. Farrell.

President M. E. Farr, of the Detroit Ship Building Co. has closed contract for the construction of two bulk freighters, of Canadian canal size, for the George Hall Coal Co., of Ogdensburg, N. Y. The vessels will be 247 ft. long, 43 ft. beam and 21 ft. deep, and will be equipped with triple-expansion engines, cylinder diameters 18, 29 and 48 in. by 40-in. stroke, supplied with steam from two Scotch boilers, 12 ft. diameter and 11.5 ft. long.

The bulk freighter L. V. Stoddard, building for the Boston & Virginia Transportation Co., of Boston, was launched from the yard of the Toledo Ship Building Co., on Sept. 21. The Stoddard is a duplicate of the George E. Warren, which was delivered to the same company on Oct. 1. The steamers are of Canadian canal dimensions, being 260 ft. long, 43 ft. 6 in. beam and 27 ft. molded depth. They are intended for use in the coal carrying trade between Boston and Virginia ports. The Stoddard will be delivered about Nov. 1.

The Wilson Transit Co., of Cleveland, has given contract to the American Ship Building Co., to reconstruct the bulk freighter Andrew Carnegie, making her of arch construction with side tanks and 12 ft. center hatches. She will also have new boilers.

The Wyandotte yard of the Detroit Ship Building Co. was considerably damaged by fire on Sept. 28, entailing a loss of about $50,000. The new steamer building for the Cleveland & Buffalo Line was not damaged.

Praise for City of Detroit III

N. H. Campbell, general manager of the Hudson Navigation Co., went to Buffalo some time ago to inspect the City of Detroit III. He writes that he was very agreeably surprised at her size, decoration and arrangement and fittings of her rooms, adding that while he recently inspected the new liner La France, of the French Line, he believed the City of Detroit III to surpass her in workmanship and detail.

Iron Ore Shipments

Iron ore shipments during September were 7,287,230 tons, making total shipments to Oct. 1, 36,338,382 tons. This is an increase of 11,501,245 tons over the corresponding movement during 1911, and an increase of 1,237,518 tons over 1910. It is clear therefore that the movement for the season will

be in the neighborhood of 45,000,000 tons, as the shippers intend to make record movements during the months of October and November, should the weather be favorable.

Following are the shipments by ports:

Port.	Sept., 1911.	Sept., 1912.
Escanaba	668,595	770,974
Marquette	367,964	566,178
Ashland	368,945	757,764
Superior	1,563,836	2,031,086
Duluth	1,131,247	1,652,735
Two Harbors	1,130,482	1,508,493
Total	5,231,069	7,287,230
1912 increase		2,056,161

Port.	To Oct. 1, 1911.	To Oct. 1, 1912.
Escanaba	3,086,847	4,010,985
Marquette	1,568,711	2,567,578
Ashland	1,878,786	3,623,161
Superior	7,946,109	11,097,276
Duluth	5,501,364	7,729,187
Two Harbors	4,855,320	7,310,195
Total	24,837,137	36,338,382
1912 increase		11,501,245

Lake Ore Receipts

Out of total shipments of 7,287,230 gross tons of iron ore during September, 5,536,291 tons came to Lake Erie ports, distributed as follows:

Port.	September, 1912.
Buffalo	748,672
Erie	72,463
Conneaut	1,030,911
Ashtabula	1,281,361
Fairport	287,083
Cleveland	1,184,249
Lorain	527,834
Huron	46,238
Sandusky	....
Toledo	301,770
Detroit	55,710
	5,536,291

Purchase of River Property

John W. Hubbard, of the Hubbard-Bakewell Co., and associates have taken over the vessels and dock property of the Pittsburgh & Cincinnati Packet Co. The new company has also purchased outright the Pittsburgh & Zanesville Packet Line with terminal property at Zanesville, McConnellsville, Beverly and Roxburg, O., and negotiations have also been practically concluded for the purchase of the Point Pleasant Dry Dock Co., Point Pleasant, W. Va., and it is understood that a second set of dry docks will be built there. The capital of the new organization is $3,000,000.

Commerce of Lake Superior

The commerce of Lake Superior for the month of September was 10,467,782 net tons, making the fourth month in which the 10,000,000-ton mark has been exceeded, and is only 385,071 tons less than the August movement, which was the canal's record movement for any one month. The commerce to Oct. 1 was 51,952,708 tons as against 39,438,167 tons 1911, an increase of 12,514,541 tons. Following is the summary:

EAST BOUND.

	To Oct. 1, 1911.	To Oct. 1, 1912.
Copper, net tons	83,312	73,784
Grain, other than wheat, bushels	21,912,198	29,781,501
Building stone, net tons	4,367	2,282
Flour, barrels	4,579,336	5,222,533
Iron ore, net tons	23,652,487	35,090,169
Pig iron, net tons	25,596	11.994
Lumber, M. ft. B. M.	403,644	487,852
Wheat, bushels	41,043,359	78,173.355
Unclassified freight, net tons	101,169	163,278
Passengers, number	35,054	29,899

WEST BOUND.

	To Oct. 1, 1911.	To Oct. 1, 1912.
Coal, anthracite, net tons	1,485,087	1,321,452
Coal, bituminous, net t'ns	10,079,890	9,544,129
Flour, barrels	125	....
Grain, bushels	1,100	100
M'n'f'ct'd iron, net tons.	275.949	447,762
Iron ore net tons	12,622	6,660
Salt, barrels	480,277	486,719
Unclassified freight, net tons	882,971	946,675
Passengers, number	39,523	32,603

SUMMARY OF TOTAL MOVEMENT.

	To Oct. 1, 1911.	To Oct. 1, 1912.
East bound, net tons	26,630,196	39.613,431
West bound, net tons	12,807,971	12,339,277
Total	39,438,167	51,952,708

The total number of passages to Oct. 1, 1912, was 16,543, and the net registered tonnage, 41.127,004.

Steamer Nantucket Turned Turtle

The accompanying photograph shows the steamer Nantucket of the Merchants & Miners Transportation Co.'s fleet in a most unusual plight. The Nantucket arrived at Baltimore on Sept. 2, and while discharging at the Baltimore & Ohio pier at Locust Point, smoke was discovered coming from the lower forehold, about five car loads of freight remaining in the ship at the time. The ship's fire appliances were immediately put into operation and a general alarm turned in, which was responded to by fire engines and fireboat. The fireboat ran a hose through a lower off-shore port and a great volume of water was pumped into the ship, which was moored to the dock. There is a slight sloping bank abreast the dock and as the ship settled in the water her port bilge took up the bank, giving her a slight starboard list. The great volume of water in the hold and on the upper 'tween decks then caused the ship to list rapidly before the lower port could be closed. When this port went under water the ship gradually settled on her starboard beam ends, as shown in the photograph.

The Merritt - Chapman Wrecking Co. are now raising the Nantucket. The fire damage to the ship is trifling.

THE MERCHANTS' & MINERS' TRANSPORTATION CO.'S STEAMER NANTUCKET TURNED TURTLE AT HER DOCK AT BALTIMORE AS THE RESULT OF A FIRE

Personals

E. L. Corthell, of New York, one of the best known American engineers, is now visiting Switzerland.

Harvey D. Goulder, general counsel for the Lake Carriers' Association, has left for Europe for a brief vacation.

Frederick L. Lane has been appointed general manager and treasurer of the Nantasket Beach Steamboat Co.

Thomas L. Delehanty, chief engineer of the steamship Admiral Dewey, has been appointed business manager of the Marine Engineers' Beneficial Association of the port of New York.

Capt. H. D. Doxrud, of the Red Star Liner Lapland, has been appointed to superintend the construction of the three new ships building at Birkinhead, England, and which are intended to operate in the New York-Norway service.

Dr. Edwin J. Clapp, assistant professor of trade and transportation in the New York University School of Commerce, has been appointed traffic expert by the directors of the port of Boston to devote a year to the study of transportation conditions in Boston and other Atlantic coast ports.

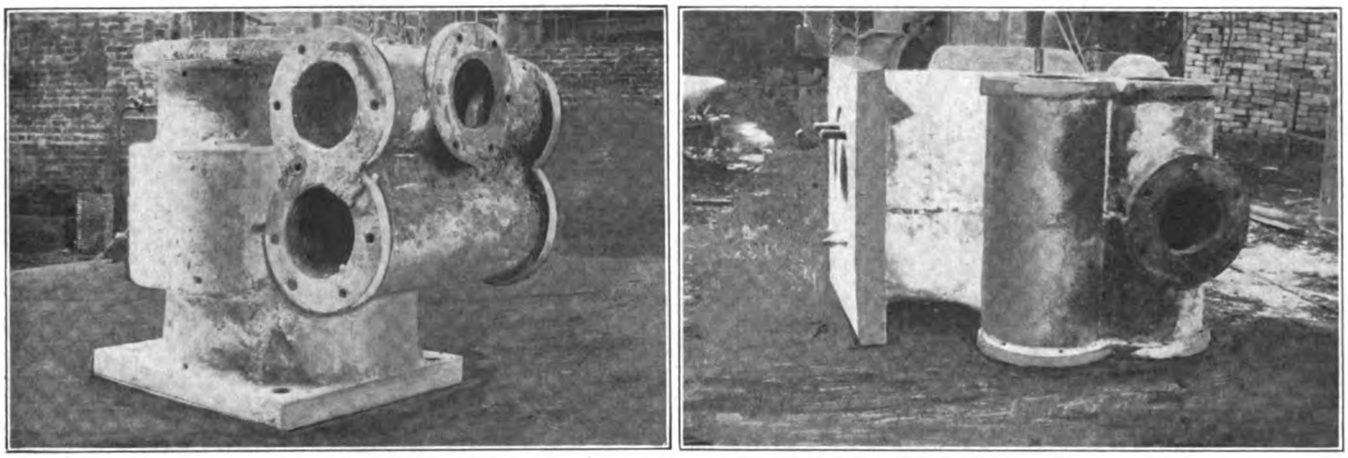
Cylinder Repaired by Welding

On the morning of Aug. 17 the cylinder on the tug Cooper, owned by the Great Lakes Dredge & Dock Co., showed a crack along half the length of the steam chest and across the top flange. The cylinder was removed at once, and taken to the shops of the Great Lakes Welding Co., of Cleveland, reaching there shortly after noon. The cracks were welded by the oxy-acetylene process, and the cylinder was back in place and the engine turning over by noon the following day. The repairs and the re-assembling required just 24 hours. The welded cylinder was not only as strong as before, but far stronger, due to the heavy re-enforcement of metal that was built on the weak section which cracked.

Since the job was finished, another cylinder of the same type, also belonging to a tug owned by the same company, went through itself, cracking off the entire top flange, shattering the piston and causing several small cracks on other parts of the casting, and even better time was made on the repairs by the same company and the cost of the welding was only a nominal figure, compared to the cost of new castings.

Some exceptional boiler repairs have also been made by this process. Several very large fire cracks in boilers of a number of steamers were repaired while the vessels were discharging their cargo. The great saving in time and money is bringing the process into favor with most of the vessel operators, the saving in time alone amounting in many cases to several days.

Tests of plates, welded, made by the local United States steamboat inspectors show tensile strength to be over 96 per cent of the original without re-enforcement. More recent tests made in the laboratories of the Case School of Applied Science show even better results—in fact, all the welded coupons broke outside of the welds.



CYLINDER OF TUG COOPER REPAIRED BY WELDING PROCESS

Satisfactory Trials of Fordonian

The Clyde Ship Building & Engineering Co., Port Glasgow, Scotland, are building for Norcross & Co., of Toronto, a steamer of Canadian canal dimensions for service on the Great Lakes to be equipped with Diesel engines of the Carels two-cycle type. The new steamer is named Fordonian and has recently undergone some satisfactory trials, as the following letter from the shipbuilding firm to Carels-Freres, Ghent, under date of Sept. 23, will show:

"As you have doubtless heard from Mr. Gaston, who was with us on trial on Saturday, the engines we have fitted to the M. S. Fordonian had a very satisfactory trial on Saturday.

"We left our basin at 8 a. m. and as soon as we got into the river, the engines were started, and from that hour on until 9 p. m. they were not stopped excepting by orders from the bridge.

"During the whole of the 13 hours the behavior of the engines was entirely satisfactory, and all the visitors we had on board were immensely pleased with what they saw. After running on the mile for some hours and testing the speed of the ship, the superintendent engineer, Mr. Duguid, wished to put the engines under some maneuvers, which he said was something like what they were accustomed to in going through the canals in the Canadian lakes. Mr. Duguid was somewhat suspicious that the air supply would not be sufficient to give the number of maneuvers necessary for their business out in Canada. The test was a particularly severe one, and for 40 minutes the engines made 61 maneuvers. It was a much more severe test than ever we have seen a steam engine put to, but the engines stood the test satisfactorily.

"For the trial we had invited a number of our friends, most of them influential people in the engineering world, and we had a representative from the British admiralty, who had instructions to make a special report for the first lord of the admiralty, and we had representatives from the imperial Japanese navy. We had engineers from Australia, from Canada and from quite a number of the big ship-owning firms of Great Britain and Ireland. Everyone present was more than delighted with the behavior of the engines, both in their steady working and their maneuvering capabilities, giving them quite a new idea of what a Diesel engine is.

"We are entirely satisfied with the trial, and you will no doubt be equally pleased to hear that this, the first engine we have done, has come out of its trials so successfully."

The Hamburg-American Line has asked for an extension of its piers at Hoboken on the ground that its present piers are not long enough to accommodate the new liner Imperator, which will make her maiden voyage to this country next April. In its application the Hamburg-American Line makes the announcement that the two sister ships which will follow in 1914 and 1915, will be even larger than the Imperator.

What It Is And What It Can Do

"Thermit" is a mixture of finely divided aluminum and iron oxide which when ignited burns up and produces liquid steel at a temperature of 5,400° F. This poured into a mold surrounding a broken section and owing to its intense heat dissolves the metal with which it comes in contact, amalgamating with it to form a homogeneous mass when cool.

It Welds

Broken Sternposts, Rudderposts, Rudder Frames and all other heavy wrought and steel sections. Very little dismantling is necessary.

¶ The welding is accomplished quickly, returning the vessel to service in a few days, saving a great deal of time and expense.

¶ Our pamphlet 25-E and "Reactions" are interesting to read. Send for them.

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These boilers hold the record for economy, capacity and endurance in the Navies of the World.

They have shown the same characteristics in the Merchant Marine. Babcock & Wilcox Boilers and Superheaters in one vessel are *saving more than 15 per cent.* over Scotch boilers in sister vessels.

Is a reduction in your coal bill of any interest to you?

Babcock & Wilcox Boilers have all essential parts heavier than corresponding parts in Scotch boilers, giving greater security against corrosion. They are lighter, safer, easier to clean and to operate than Scotch boilers, and much more efficient.

We are constantly receiving "repeat orders" from owners of merchant vessels who have had many years' satisfaction from the earlier installations.

Write us for details

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INSURES QUALITY

Grades—Best, U S. Navy, and Navy, both Spun and Unspun.

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Give us an opportunity to show you the quality of our goods.

We were established in 1840, and for over 70 years have been doing a business that has been made possible only by "Square Dealing".

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Let us hear from you at once.

W. O. DAVEY & SONS
JERSEY CITY N. J.

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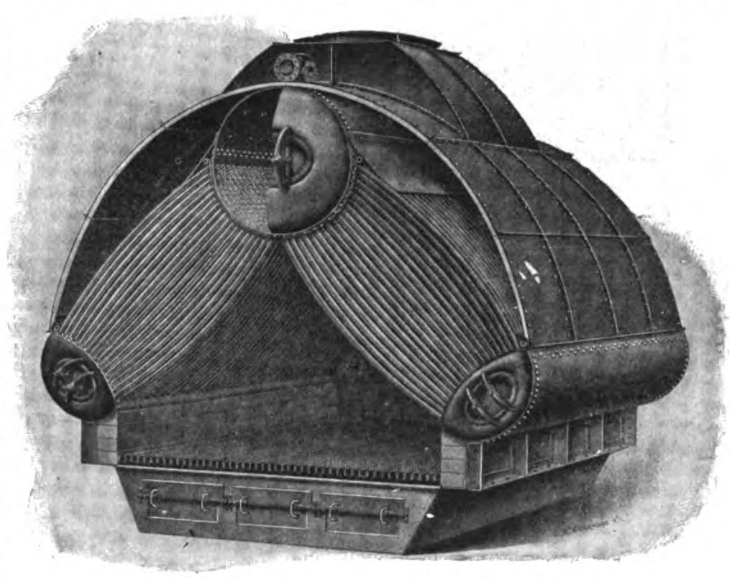


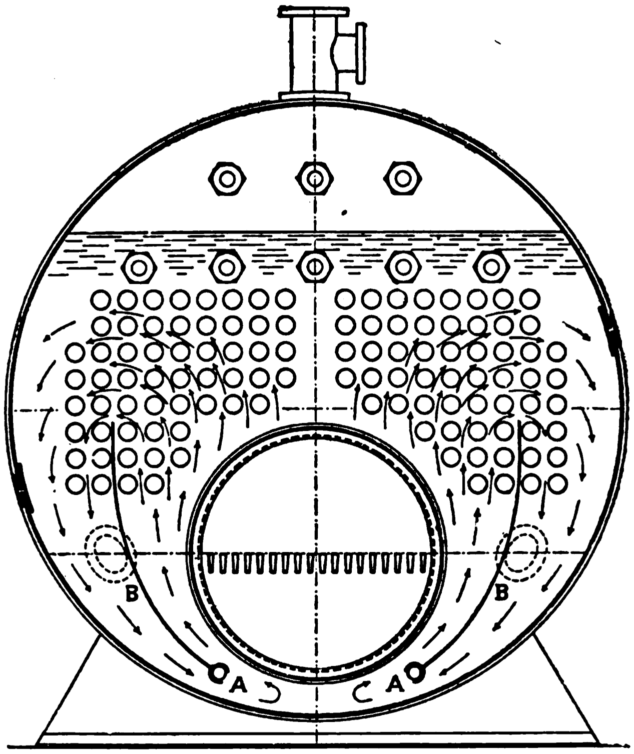
Adapted for the highest grade service, Torpedo Boats, Destroyers, Battleships, and large commercial vessels. Steam drums up to six feet in diameter, larger water and steam room capacity than any other boiler.

Any tube can be replaced without disturbing any others. Fifty tubes removed through one hand-hole. Curvature of tubes just sufficient to avoid expansion troubles. Greatest facility for cleaning interior and exterior of tubes. No screwed joints, all tubes expanded. All parts of wrought steel. Send for catalogue.

MOSHER WATER TUBE BOILER CO.
30 Church Street, NEW YORK

Copeland Automatic Circulating System

An interesting circular on the subject of circulation of water in steam boilers has just been issued by the E. T. Copeland Co., 100 William street, New York, proprietors of the Copeland patent automatic circulator and system for marine and stationary Scotch boilers. The circular opens with a general description of the Scotch boiler which has done reliable service for the past 50 years, but whose lacking quality is that of natural circulation of its water contents, causing it to lose a portion of the calorific value of the coal consumed. The Copeland patent automatic circulating system is a simple structural addition to boilers of the Scotch type, which, it is claimed, will establish and maintain natural circulation. It consists of two rectangular plates of steel or other metal of such length as to extend from head to head of the boiler and of such width that when in position they will extend above and below the grate level or fire line. They are erected edgewise upon suitable means of support located below the grate line. The plates are curved to correspond approximately with the radius of the furnace. They are designed to reach from a point near the center of the bottom of the boiler to an indeterminate point above the bottom course of fire tubes. The method of supporting the plates is shown in the diagram accompanying. Tubes AA support plates BB and incidentally supply hot air to the combustion chamber.



Tubes A A support plates B B and supply hot air to combustion chamber.

The tubes are inserted and expanded in the heads in the usual manner. Bolts, rivets or other fastenings are not employed. When properly placed each plate becomes a partition which sub-divides the space between the furnace and the shell, so that a definite and undisputed pathway is provided for an uprising current on the inside, and a down-flowing current on the outside. Its inter-position permits the water to move in diverse directions without conflict; and the respective influences of heat and gravity force it to follow a certain course, and to make a complete circuit. It is obvious that the water contained between the plate and furnace, adjacent to the fire, will be directly and continuously heated, and its density thereby reduced. It will, therefore, naturally rise and be coincidently followed by water from below. This is the starting point of the uprising current above mentioned.

On the other hand, the water in the space between the plate and the shell, being out of touch with heating surfaces, and also in contact with the shell, loses, rather than gains, heat, and its density is consequently increased. It therefore follows the law of gravitation and naturally descends, via the pathway provided for its transit, to the bottom of the boiler, where it turns the foot of the division plate, and meets the demand of the uptake for a constant supply of water for re-submission to the heating surfaces.

It is contended that the device establishes and maintains natural and complete circulation throughout the boiler; beginning immediately upon starting fires, and operating automatically and continuously until the fire is extinguished.

Trade Notes

The National Tube Co., Pittsburgh, Pa., has just issued a booklet on modern welded pipe, and in conformity with all the publications of this company, it is a fine example of the printer's art. The book is, in fact, a history of the industry and is replete with information concerning modern tubular products. The company has enormously expanded during the past decade, its production of tubular goods in 1900 being 416,064 tons and in 1909, 1,013,071 tons. The book traces the process of manufacture from the ore in the ground, and is therefore of great interest even to the layman. In order to identify its products, the company follows the practice of rolling in raised letters of good size on each few feet of every length of welded pipe the name "National," except, of course, on the smaller butt-weld sizes. on which this is not mechanically feasible.

A valve-closing water-tight receptacle has been introduced by the Conlan Electric Co., of New York, the valve being employed in place of the portable cover to close the opening disclosed by the removal of the plug. The closing action of the valve and valve spring is also used to make a quick break of the electrical connections when the plug is withdrawn. Another strong feature is in the cam means of connecting the plug to the box, which compresses a gasket (carried by the plug) on the face of the box, making a water-tight joint. Therefore, the operator, who is usually unskilled, is not required to do more than to make and break the electrical connections, as the box is made water-tight automatically. The United States army have adopted the device exclusively, and it is also used on United States battleships and on steamships and yachts.

The new steamer to be built for the Matson Navigation Co. by the Newport News Ship Building & Dry Dock Co., Newport News, Va., will be equipped with Babcock & Wilcox boilers.